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Development of a Needs-Based Curriculum Plan in Environmental Education.

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DEVELOPMENT OF A NEEDS-BASED CURRICULUM PLAN IN ENVIRONMENTAL EDUCATION

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DEVELOPMENT OF A NEEDS-BASED CURRICULUM PLAN IN ENVIRONMENTAL EDUCATION

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ABSTRACT

A curriculum plan in environmental education for Louisiana was developed, based on needs established by analyzing the results of testing 1,412 tenth grade students from 53 public secondary schools in Louisiana for their knowledge and opinions about the environment. The instrument used in the survey consisted of 43 cognitive and 20 affective questions. The instrument was developed from objectives selected from other state plans by a panel of 35 scientists and educators from 12 departments at Louisiana State University, Baton Rouge, Louisiana.

Fifty-four public secondary schools were randomly selected. Fifty-three schools, 98 percent of the sample, returned the answer forms. A total cognitive score was determined along with a sub score for five major areas: general ecology, population, resource, energy, and pollution. Analyses of variance were conducted to determine if there were any significance among regions of the state, between sex, between urban and rural communities, and among size of school.

The results showed that the students had limited knowledge for most of the cognitive variables. Needs for a curriculum plan were demonstrated in all five cognitive categories. The over-all attitudes and opinions demonstrated that the students favored ideas that did not affect them directly while showing disagreement with those issues that would affect them directly.

The plan suggests a multidisciplinary approach to teaching environmental education. The plan developed from the results of this study shows how various general objectives can be integrated into many different traditional subject areas.

CHAPTER 1

INTRODUCTION

Background of Study

As the first pictures of earth returned from the Apollo moon landing during the summer of 1969, over one billion people saw the earth as never before. The earth appeared as an outpost in a sea of non-living matter. Many began to realize that the life support processes that maintained man and all other forms of life were hinged on many interacting cycles. This realization spurred many people to become actively involved with the growing "environmental movement" of the 1970's. As population increases and food demands rise, resources become more depleted, and the threat to the system that supports man and all life becomes more apparent.

Earth Day 1970, illustrated the great concern that developed during this period. Many people began to visualize that they could choose a future by planning, by conserving, and by knowing the facts about the alternatives. During that same year the United States Congress passed the first act to inform its citizens of the pressing environmental problems, the Environmental Education Act (1970).

The Environmental Education Act (1970) was designed to assist state and local governments, private organizations, and educational institutions to establish and carry out

innovative and meaningful environmental education programs. The Act provided the impetus to get the environmental education movement off the ground and was to help in the financial backing for a comprehensive, continuing, and national environmental program.

President Nixon, in his August, 1970, first annual report on the Council of Environmental Quality, stated:

> We must seek nothing less than basic reform in the way our society looks at problems and makes decisions. Our education system has a key role in bringing about the reform. . . It is also vital that our entire society develop a new understanding and a new awareness of man's relation to his environment that might be called "environmental literacy." This will require the development and teaching of environmental concepts at every point in the educational process.

The decade of the 1970's was described by then Commissioner of Education, S. P. Marland, Jr., as the "environmental decade." Commissioner Marland stated:

> We know and see environmental education as a new approach to learning. Even as attitudes of individual worth, free agency, democratic consent, and cooperative effort are learned subconsciously in many parts of the school curriculum, so must new attitudes of environmental concern pervade each subject, each course, and each discipline, whether it be in mathematics, English, science, social sciences, music, or whatever. Environmental education is teaching at all levels (Marland 1971).

In order to achieve the goals suggested in these two statements, a new thrust must be made in the area of environmental education. This effort must be based on sound research and wise curriculum development.

Early efforts in environmental education were first made in outdoor education, conservation education, and resource management. However, these programs traditionally reached a small audience. Nature societies, 4-H Clubs, Boy Scouts, and other conservation groups have always stressed a strong environmental approach to learning. Value-oriented programs such as the ones offered by these groups are very effective; but, when a large pluralistic society is in need of becoming environmentally literate, a more massive program is needed. The most logical means by which to produce an environmentally literate society is through existing educational institutions.

Most educators agree that the development of a comprehensive multidisciplinary environmental education program is essential, but little is known about how and where such a program should be implemented. Many environmental educators point to a national program, while others suggest that the local democratic processes must come into play. One thing is certain: little information is known about students' knowledge, attitudes, and opinions about the environment, and at what level students are most likely to adopt new attitudes and behavioral patterns.

Importance of Study

As a result of increased demand for programs by educators in the field of environmental science there appears to be a need for efforts directed toward the development of environmental education plans and materials. This concern has created new questions such as:

1. What definitions and usages are appropriate for the terms "environment" and "environmental education?"
2. Should environmental education programs be about the environment, for the environment, or in the environment?
3. What topics should be included in a course?
4. Should environmental education be provided in the form of separate courses of study, or should an interdisciplinary approach be used in which environmental education is merged with other courses of study?
5. To what age-range of student should environmental education be addressed?
6. Should the full thrust of school-based environmental education programs be completed by the twelfth grade?
7. What course goals should be specified?

8. Which course goals can and should be expressed in behavioral terms?
9. What curriculum domains should be used?
10. What evaluation procedures should be applied to both the student outcomes and to the environmental programs?

To provide a background for such a program an even more basic question needs to be asked: "What do students currently know about the environment, and what are their attitudes toward the environment?" While this question is always of relevance in curriculum development, it takes on a new importance in environmental education. In environmental education, unlike subjects such as mathematics or English, the matter of educating the public about the environment has not been left to the schools. Government agencies and private organizations have been involved also. It may be possible that the educational activities of such interested parties already have established in the students the attitudes which public institutions initiating environmental education programs might set out to develop. Information about prior knowledge and current attitudes is of importance, especially in situations where state-wide curriculum planning is anticipated.

Tower and Swan (1972) wrote that "As a first step toward creating such an environmental education program, we must know what we can build upon, what is the status of the students' knowledge and attitudes about the environment." Unfortunately, this question has not received much attention from researchers. Eyers (1973), in a study conducted in Australia, stated: "Prior information about general environmental knowledge and attitude structures seems of real importance especially in a situation in which coordinated or national curriculum planning is contemplated."

Disinger (1976) reported that forty-six states have some kind of environmental education program operating either at the local level through nature centers or school boards, or through the state department of education. In Louisiana, four parishes have actively taken a lead in developing environmental education. All four parishes, Caddo, Bossier, Orleans, and St. Martin, have developed "nature centers" that are utilized for environmental awareness programs at grades K-12. Louisiana does not have an environmental education program at the state level, but plans for such a program are being developed. One resource guide was produced by the Louisiana State Department of Education in 1976 from materials produced by the U.S. Forest Service and the National Park Service. The "Natural

Resources Activity Guide," Bulletin 1232, was to be used in conjunction with Environmental Education Teacher Workshops. The guide defined the term "environmental education" and pointed to several objectives relevant to today's problems. However, Bulletin 1232 was not as affective as intended. In the summer of 1979, an effort to begin some kind of environmental education oriented program was initiated (McGehee 1979). An Energy Guide was developed by the Science Section of the Louisiana State Department of Education for grades K-8 (Louisiana State Department of Education 1979). This guide covered one of the major areas that is included in most environmental education programs. Although, another such guide for grades 9-12 is anticipated for 1980, this program will deal with only one of the pressing problems associated with environmental awareness, energy. Before the State of Louisiana develops a comprehensive program in environmental education, some research is needed to assess what level of environmental awareness exists among students.

Leftridge (1977) stated that all students should be surveyed relative to the environmental issues which are relevant to their lives before attempting to embark on any environmental program. His conclusions indicate that the next step in developing a curriculum plan in environmental education at the state level should focus on research

related to the knowledge level and attitudes students have about the environment. At the present there has been no such study conducted that indicates the environmental knowledge and attitudes of students at any grade level in Louisiana, nor has there been developed any curriculum plan related to environmental education. The testing and analysis of responses pertaining to the environmental knowledge and opinions that students have toward their environment and the development of a curriculum plan based on the results of the data gathered were the objectives of this study.

The need for a program in environmental education seems apparent since Louisiana does not have a statewide program. Yet, prior to the development of any program, students should be surveyed to determine what should be taught and who should be taught. Many existing programs in science, for example, may offer a framework in which special units or topics dealing with the environment may be introduced. By surveying students' knowledge and attitudes of the environment, teachers and educators will be able to determine what the students already know and what their attitudes are about the environment. Furthermore, such a survey might be used as a baseline by which future programs may be evaluated or critiqued. Changes in knowledge and attitudes might well establish relationships between

environmental knowledge and attitudes that have program implications. Differences between regions of the state, community type, and school size may be established, which would be helpful in the development of a statewide program. By using questions developed from curriculum plans from other states and by experts from various environmental science fields, it will be possible to compare the relative environmental knowledge and attitudes of Louisiana to other states. Looking beyond the scope of this study, the survey data may well be of value in follow-up studies. As other states and countries are surveyed, more extensive cross-cultural comparisons can be made. This may then provide some insight into the "exportability" of existing environmental education programs (Richmond and Morgan 1977).

Statement of the Problem

This study will develop a needs-based curriculum plan in environmental education based on the assessment of tenth-grade high-school students' knowledge about the environment and their opinions about certain problems related to the environment.

Questions to be Answered

This study was designed to collect data that might assist in providing answers to the following questions:

1. What is the present environmental knowledge level of students?
2. What are the current opinions of students toward environmental problems?
3. What do students currently perceive to be the most serious local, regional, and national environmental problems?

CHAPTER 2

REVIEW OF LITERATURE

Overview

Several extensive reviews of the literature relating to all areas of environmental education may be found in Roth and Helgeson (1972) and Roth (1976). This discussion will cover those studies that pertain to cognition, attitudes, opinions, and behavioral change toward environmental education concepts or experiences.

The earliest studies concerning attitudinal or behavioral changes centered around the traditional mode of environmental environmental--outdoor education. The impact of camping on effecting change in attitudes and behavior was first reported by several investigators in the early 1950's and 1960's. Heppel (1964) investigated changes that 45 education majors underwent during their junior year in college after experiencing five days in a school-camp situation with children. Data were obtained through a questionnaire, a daily log, a supplement to the log, and by an attitude scale of teaching values. Heppel discovered that students who majored in elementary education reacted differently than secondary education majors. He further noted that all students showed signs of anxiety during the first two days but showed increasing signs of confidence

later in the week of camping. Attitudes which were changed included: awareness of the different environment, appreciation for informal group activities, and insights into children's interest spans. Elementary education students generally developed more positive attitudes toward camping than their secondary education counterparts.

In a similar study, Hauserman (1963) focused on the classroom performance differences between student teachers who had participated in an outdoor orientation program and those without this orientation. The experimental group received an introduction to outdoor education by viewing and discussing films of a sixth-grade camping program in action, and by becoming actively involved in a school camping program while taking part in a school outdoor educational unit. The control group attended classes in the required educational sequences but did not participate in outdoor education activities. Both the control and experimental groups were scheduled for student teaching internships during 1962-1963. Hauserman used the Conservation Schedule and Record (Hauserman 1963) to make observations. He concluded that there was a difference in student behavior between classrooms and that this difference was due to the warmer emotional climate in the classrooms where the student teachers had an orientation to the outdoors.

Rupff (1957), investigated the extent to which the goals or objectives of school camp programs were being achieved. The objectives for short camping programs were identified by examining self-realization, human relationships, economic efficiency, and civic responsibility of the campers, parents, teachers, and administrators. Rupff found that there was no difference among camper responses, and that parents and teacher-counselors were more enthusiastic than students and administrators in their responses. Teachers emphasized programs and curricula, where as administrators emphasized administrative aspects. Most of the supervisors knew little of what was being done in the programs.

Another study by Kranzer (Hammerman et al 1969) was more concerned with pupil behavior. He examined the effects of a five-day resident camping experience on two sixth-grade classes as compared to a class which did not participate in the camping activities. He considered the social, emotional, intellectual, physical, and democratic aspects of group living. Kranzer's main conclusion was that social and democratic behavioral changes took place more rapidly during a camping program than during a regular school classroom. Students with low mental ability showed a slight improvement in critical thinking.

All of these studies indicate that through participation in outdoor educational programs, students' interests are stimulated and positive behavioral changes can take place, often carrying over into the classroom.

Existing Attitudes Toward Environmental Issues

Swan (1969) reported from a study of twelfth-grade high school boys in Detroit, Michigan, that air pollution was the most common environmental problem chosen from a list of environmental and social problems. Swan also discovered that, despite the high concern expressed for air pollution, the subjects knew relatively little about air pollution.

Trexler (1963) investigated the relationship between the testimony of elementary school children in an urban classroom and their observed behavior regarding conservation values. He found that the correlation between what they said and what they actually did was not strong enough to suggest their testimony could be relied upon to ascertain their actual conservation values or behavior.

In a study designed to determine whether knowledge and understanding resulted in a more favorable attitude toward conservation, George (1966) found significant differences in the attitudes among three groups: high school students, college students, and adults. Of the personal characteristics studied, age and education were associated

with the most significant differences in the attitudes of the high school students. The most significant characteristics in the college student group were age and sex, while sex and residency background were significant for adults. Extra-curricular activities involving conservation clubs and nature clubs had the greatest positive effect in the development of conservation attitudes. George also found that attitudes toward conservation did change and that the changes were associated with interest motivation and exposure to conservation knowledge. He noted that significant attitude change could be identified and associated with the special conservation experiences designed for each of the groups.

Hug (1964) showed how factors which either encourage or discourage the use of environmental instruction activities by intermediate elementary school teachers could be analyzed. He developed an instrument for interviewing teachers about school-teacher-environmental oriented factors. The factors were listed on a continuum from strong encouragement to strong discouragement. Teachers using environmental outdoor activities were compared to teachers who did not utilize the out-of-doors. He found that most factors were not statistically significant. He discovered that teachers active in outdoor activities were younger, had attended more college outdoor-related courses, and had been

enrolled in college more recently than the non-active teachers. The classes with one or more low IQ students used the out-of-doors less often.

Hoover and Schutz (1964) investigated whether differences in conservation attitudes existed between science and non-science majors in selected colleges and universities throughout the country. The main reason that a comparison of science and non-science majors was undertaken was because conservation education has traditionally been handled within the confines of science education. They found that there were no significant differences among groups. From this Hoover and Schutz concluded that science education had little impact on basic conservation attitudes and that the effect of college curricula upon modification of basic attitudes was far from encouraging.

Eastman (1973) used a semantic differential instrument containing 13 concepts and a unit on litter pollution to develop and validate an environmental attitude measure. He utilized Maryland sixth graders in a 5 to 15 hour instructional unit and compared two types of instruction, teacher-centered and student-centered. Half of the students were pre-tested before the instruction period, and all of the students were post-tested. No significant advantage of either teaching method was discovered, and no significant attitude changes were identified after the instruction

period. Eastman suggested that both the weakness of the materials and the time element may have affected the results of the research. However, he claimed that semantic differential techniques showed promise as a method of measuring attitudes with predictive validity.

Leith (1973) developed an elementary environmental attitudes program that was designed to be used with student teachers during their practice teaching. He reported that some attitude changes by both students and student teachers occurred. The results of Leith's findings were based on pre- and post-tests using the Environmental Semantic Differential, the Questionnaire on Environmental Problems for the student teachers, the Environmental Semantic Differential, and the Environmental Concern Inventory for the children. Leith concluded that time was the major factor initiating change (Roth 1976).

Knowledge and Attitude Surveys

Hounshell and Legget (1973) studied approximately 1,900 sixth-grade students in nine school systems in North Carolina. They used an Environmental Knowledge and Opinion instrument that contained 35 knowledge items and 30 attitude items. The overall mean was 14.3 for the knowledge section and 16.4 for the attitude section. They found that girls scored significantly higher than boys on the attitude

section but not on the knowledge section. The knowledge mean of the urban students was significantly higher than rural students (0.95 level); however, no significant difference was found among the attitude means.

Several studies have been conducted in the United States (Perkes 1973 and Bohl 1976), England (Richmond 1976), and Australia (Eyers 1973) related to environmental cognitive and affective domains.

One of the first multi-state studies was conducted by Perkes (1973). Perkes' study was designed to survey environmental knowledge and attitudes of tenth- and twelfth-grade students in 11 states and to study the effects of several variables on the knowledge and attitudes of the students. The instrument used in his study was developed by the staff of the ERIC Clearinghouse for Science, Mathematics, and Environmental Education. Three forms of the instrument were developed. The inventory was administered to 30 tenth- and 30 twelfth-grade students in 199 high schools randomly selected from 11 states. Perkes found that there were significant differences in responses by size of community and state, but no significance was noted in the proportions based on sex or grade level. He also found that males did significantly better than females on items requiring knowledge of facts but did not on items dealing with general environmental concepts. The size of

the community where the respondent lived and went to school was not significantly related to knowledge of environmental facts and concepts but was more related to the problems he thought were the major environmental problems in his community.

In a similar study, Bohl's (1976) results paralleled those of Perkes. Bohl utilized 22 states in his environmental assessment. Bohl's study was designed to measure cognitive and affective environmental information among tenth and twelfth grade high school students. A sample of over 15,000 students was drawn so that the population distribution in each of the 22 states was accurately reflected. Over 270 schools were used in the sampling. Bohl utilized the same inventory that Perkes used in his study. The results showed that the response frequencies were within two percent of Perkes' data, confirming nationwide consistency. Sex was found to be statistically significant on one-half of the inventory items. Grade level was found to be a significant variable on about one-fourth of the inventory items. Correlation analyses identified three subpopulations: a small number of students with a high level of information and possessing positive attitudes, a larger number of students with a low cognitive level of information and positive attitudes, and a small number of students with a low amount of cognitive

environmental information and negative attitudes. The attitudes possessed by high school students were termed "learned responses" since the correlation between these was very low. Therefore, those responses were not considered to have been firmly established on the part of the student.

Richmond (1976) and Richmond and Morgan (1977) conducted a nationwide survey in England to establish baseline data relating to the environmental knowledge and beliefs of fifth-year secondary students. Relationships between certain variables were also examined. The instrument developed for this study consisted of three questionnaires similar to the one developed by Perkes (1973). The questionnaire was administered to 30 students of the fifth-year (equivalent to the tenth grade in the United States) in 500 randomly selected secondary schools in England. A total of 383 schools (76.6 percent) returned completed answer sheets providing information from over 1,100 students. They found that students had a poor base of environmental knowledge but demonstrated good knowledge of environmental concepts and a moderately positive attitude toward the environment.

Eyers (1973) conducted a similar survey in Australia, developing an instrument from Perkes' (1973) instrument. Eyers found that while the environmental knowledge level of students in Australia was low, the attitudes of the students

toward environmental conservation issues were quite positive. Several responses, however, indicated that when confronted with a choice between material values and environmental concerns, the students' attitudes appeared more "fragile." Eyers also found a moderate correlation between knowledge and attitude scores. Many of the items used in her questionnaires are related to those found in other surveys, thus making it possible to compare studies internationally.

McTeer (1977) reported that a teenage group studied in a suburban area of Atlanta had a greater concern for the environment than the adults in the same area. Similarly, he found that secondary school personnel have less concern for environmental issues than certain other groups, especially students and parents of students. His suggestion was that teacher education programs at the pre-service and in-service level should give greater emphasis to environmental education.

Kuhn (1979) analyzed the attitudes of secondary school students toward energy-related issues. His target population consisted of tenth- and twelfth-grade students in the southeastern United States. Kuhn's results showed that a significant difference existed among males and females on 23 of the 82 items used on the environmental-energy instrument.

One recent survey, relevant to this study, was conducted in Louisiana in the city of New Orleans, by the Office of Environmental Affairs (England et al 1980). The results indicate that the citizens of that city are concerned with the quality of the enviroment. However, the study showed that they emphasized problem areas such as waste and water pollution. Most of the respondents indicated that the government should take an active role in solving environmental problems. A large number of the respondents indicate that they would support new laws and pay additional taxes to control pollution. England found that concern for the environment increases with higher levels of income and education but decreases with age.

Review of Environmental Education Plans

Many states have implemented curriculum plans in environmental education since the Environmental Education Act of 1970. This discussion will review several plans that have contributed to this study.

Project COPEE-Alabama

The Mobile County School System (1979) developed one of the most comprehensive programs in environmental education for grades K-12, students in colleges and universities, and teachers. The "Conceptually Organized Program for

Environmental Education" consists of a 640-acre Environmental Studies Center, miles of nature trails, a 20-acre lake, an amphitheater, and restroom facilities. The program goals consist of creating an awareness of the world's environmental problems and stimulating creative thinking regarding their resolution, fostering new attitudes and values necessary for man to live in harmony with nature, instilling in students a sense of unity with the natural ecosystem and an understanding of the interdependence of living things. This could be done by complementing the content areas of the school curriculum by experiencing and observing the environment outside the classroom.

Arkansas Environmental Program

The "Arkansas Plan in Environmental Education" couples the educational program provided by the U.S. Forestry Service with the Arkansas State Parks in providing outdoor learning and work experience associated with environmental education. The objectives of the overall environmental education program for Arkansas include developing and encouraging environmental sensitivity as well as developing problem solving skills. A second major objective is to basically prepare students for the world in which they will live by providing them with the skills to handle the problems of the world and by preparing their attitudes for

the future. One major developmental feature of the Arkansas program was the development of The Farkleberry Cookbook, an activity guide for teachers. The guide accentuates role playing, problem solving, and gaming. Five major categories of environmental science are covered in the guide. The categories are problem solving, solid waste, energy, population, and environmental awareness. The guide is designed for upper elementary through high school level students (Arkansas Department of Education 1975).

Florida and Environmental Education

The State of Florida initiated a plan in 1972 which centered around a preliminary survey of school districts. This survey was conducted to determine the number of local environmental education programs already in existence in Florida. The survey revealed that many programs did exist and that these projects were initially funded in Florida under Title III of the Elementary and Secondary Education Act. Many of these programs provided outdoor education facilities. Courses in environmental problems have been added to high school curricula during the early 1970's. Project-oriented courses had been implemented in many schools, while many science departments had restructured their programs so that they were environmentally oriented. Based on the Environmental Education Act of 1970, Florida

set out to establish a master plan and an action guide. Six basic goals were stated in the "Master Plan," including: (1) recognizing that earth's biosphere is its environment, (2) realizing that mankind is a part of the environment and a system made up of people, culture, and man's physical and natural surroundings, (3) appreciating the environment as a living support system and that man has the ability to control, use, preserve, and destroy this environment, (4) accepting the responsibility for the present condition of the environment, (5) responding to the economic and political forces, social pressures, and cultural value systems, and (6) using sound constructive environmental decision-making techniques. In developing a state environmental education plan, three critical elements of an environmental management program were used as guidelines. These were: (1) inventory present resources, (2) prepare wise management policies, and (3) promote public cooperation. Curriculum development focused on the sociological aspects of the environment as well as the biological aspects. Guidelines for curriculum development were established on the basis of nine basic principles. These stressed an interdisciplinary conceptual approach spanning K-12 grades that would be integrated into the existing curriculum rather than being separate courses. Other principles stressed inquiry and problem-solving aimed

at developing attitudes rather than the acquistion of facts. Community resources and usage of environmental study-areas were also to be included in the curriculum development. Emphasis on research and additional pre-service and in-service training would be used to encourage and update curriculum changes. Finally, Florida's state plan provided several model projects for a pilot study.

Direction of Environmental Education in Georgia

Georgia envisioned a comprehensive environmental education plan in the 1970's. Their definition of environmental education overshadowed outdoor education and conservation education. Their plan referred to environmental education as "those educational activities which create awareness of and concern for man's relationship to his world and the results of abuse and neglect." Georgia's plan strongly suggested that "this sort of education would promote changes of attitude and behavior and would result in a careful stewardship of the life-giving environment, both natural and man-made" (Huskey 1974). Georgia's concept of a comprehensive environmental education program encompasses all disciplines and is thus consistent with national policy (Environmental Education Act of 1970). As in Florida's plan, the Georgia program involves the incorporation of environmental education into the existing

curricula by utilizing the natural, man-made and human resources available for instructional purposes. This program assumes that each region of the state has unique features and resources which should determine the manner in which environmental education is presented. The Georgia plan offers several examples of how environmental education can be implemented within the existing classroom, through the utilization of the school grounds, resource personnel, general field study, instructional resources, and conservation groups (Florida State Department of Education 1972).

The Upper Mississippi River ECO-Center

The ECO-Center project serves ten school districts in northwestern Illinois. The project was initiated under Title III ESEA funds in order to implement and coordinate a supplementary educational program in environmental education. The ECO-Center has been mainly involved with curriculum change in three areas: the development of an interdisciplinary approach to environmental education emphasizing the interrelationship of man and nature, the utilization of resources outside the classroom, and the focus on environmental problems and man's ability to identify and resolve them. The key ingredients to the curriculum reform include: the organization of teacher

workshops, identification and development of local outdoor education facilities, implementing locally produced and tested curriculum activities based on fundamental environmental concepts, and involving area agencies and organizations in environmental education. Program emphasis has been directed at the upper elementary grades. A second part of the ECO-Center is called the "Diffusion Project." Three initial efforts to encourage the development of the program involve inservice training of teachers, finacial support in paying substitute teachers and initial costs, and technical service assistance (Carroll County Educational Service Region 1974).

Total Environmental Education in Indiana

Indiana began early in the the 1970's to develop a comprehensive plan for its citizens. The Indiana plan is "total," encompassing six global objectives. These objectives may be summarized as an attempt to change attitudes through a set of learning experiences. Wise utilization of traditional sources of energy and support of research and development of alternative energy sources is one of the objectives which is shared by many other programs. A second objective stresses the decision-making processes relating to resource use and present and future needs. Another objective aims at involving the student in

resource reclamation. The fourth objective stresses population education and the dynamics of populations. This objective also deals with decision-making processes and states that the student should be able to defend a position on population management. The fifth objective involves the development of an awareness of the interdependence of living things in the closed earth system. The final objective urges the student to examine optional courses of action and their consequences for improving the quality of life and to support those alternatives that would provide optimum short- and long-term benefits for the individual, society, and the environment.

One of the unique ideas presented in this plan relates to conceptualized future education. As a teaching strategy, environmental education is classified as a long-range planning instrument. A second strategy involves problem-focused learning, which requires some experience in applying knowledge to problem identification and recognition of the source. The Indiana plan emphasizes the interdisciplinary relationship of environmental education, pulling man into his environment and interrelating the divergent factors that affect him. Two other teacher strategies are stressed: the student-initiated learning activity and the community-centered program. Both of these involve people in a learning situation which in turn effects attitudinal change.

Indiana's plan cites three basic components of a good program in environmental education. First, the local school districts are given the primary responsibility for developing a curriculum. The stress is to focus on current instructional areas of the school program. A second step is to encourage the development of an environmental education materials center, which would become part of a central media center. A final component is the provision of a school site easily accessible for learning in order that students might experience education (Indiana Department of Public Instruction 1975).

Environmental Education Process for Iowa Schools

In Chapter 257.25 of the Code of Iowa, the General Assembly of Iowa placed within the schools the responsibility to prepare students to become "environmentally literate" citizens capable of participating fully and intelligently in making environmental decisions. Iowa's general plan cites evidence by McRae (1978) that 68 percent of the teachers and administrators in Iowa's schools had never taken a course related to conservation education, environmental education, or the environment. The major goals of Iowa's environmental education plan are basically identical to those of the other states mentioned, but it stresses the development of an awareness of the components

of the physical, biological, and cultural environment and how these components fit together, and the development of a realization of the needs of society for natural resources and the limitations of those resources. A third goal includes the development of a working knowledge of science fundamentals and their application to natural resource management and consumption. A fourth concept stated in the goals is the clarification of a value system regarding man's responsibility to his present and future environment. A final goal of the Iowa plan accentuates understanding the political and economic interactions involved in deciding between alternatives.

Eight strategies for implementing environmental education programs in Iowa are suggested in the plan. Curriculum sequence includes three phases: (1) environmental awareness, (2) natural resource use and environmental management, and (3) environmental decision-making. The awareness phase provides experiences that interrelate man-made processes with the natural environment, and includes clarification of values. The natural resource use and environmental management phase incorporates the awareness phase in exploring natural resources. Economic, political, and social factors are involved in dealing with natural resources and are included in this stage. The environmental decision-making phase

combines the awareness and management phase to force problem-solving upon students. Ideally suited for middle school, junior high, and high school levels, role-playing causes the student to identify the real problems. The Iowa plan also includes outdoor laboratories and field experiences.

Guidelines for Environmental Education, The Kentucky Plan

The Kentucky plan spells out the nature of environmental education by first reviewing environmental education definitions. Three definitions are given, one from the U.S. Office of Education, another from a functional view, and still another expressing what environmental education is not. Basically, this plan states that environmental education is an evolving process that should be considered a tool rather than an end product. The Kentucky Plan encourages problem-solving and decision-making processes by exposing students to problems and decisions as identified by courses and environmental situations. In these, the environment becomes a focal point of specific studies and a medium in which problem-solving and decision-making processes are expressed. One major point of this plan is stated:

> Few skills are more desirable than those of problem solving and decision making. Few attitudes surpass those of survival, development, and change as they relate to an environmental ethic. As education is the means for achieving

these goals, Kentucky ranks environmental education high in priority.

Two significant goals are listed by the Kentucky Department of Education when referring to the overall educational process. These are: (1) awareness of one's relationship to the physical environment and the wise use of resources, and (2) understanding the effects of technology and of population on the environment. Basic needs are expressed in these goals, however more specific objective were spelled out in a statewide conference in 1972. This conference yielded a blueprint for the development of a plan in environmental education. Five questions were developed. These included: (1) What are we talking about? (2) Where are we now? (3) Where are we going? (4) How do we get where we are going? From these program goals, objectives and activities were initiated. Five basic goals for implementing environmental education in Kentucky were stated: (1) teacher orientation, (2) program development,(3) resource utilization, (4) promotion and dissemination, and (5) program implementation. A final section within the framework of the plan was a section on evaluation and accountability. This section updates the plan to the level of other programs that are presently being evaluated. Finally, a time frame was included within the plan to measure progress. The final implementation of the plan is to be completed by 1980 (Advisory Council for Environmental Education 1975).

Maine State Plan for Environmental Education

The rationale for developing an environmental education state plan for Maine was based on three basic areas. First, a plan would help point out the need for a program in environmental education and the public's role. Secondly, such a plan would provide for an organized, coordinated effort to meet this need. Furthermore, it would identify the economic, politial, human, and other resources which would assist statewide implementation. In the Maine program, the general recommendations are unique. The recommendations point to the development of a comprehensive plan aimed at four educational groups. These would be the formal preschool through secondary students formal higher education, formal adult education, and the non-formal general public education. Since this plan covers several broad categories, organized segments throughout Maine would be involved in the development of an adequate program. In addition to this "coalition," the State Department of Educational and Cultural Services would employ a full-time environmental education director. Similarly, a director for the entire university system would be established. Support for such a plan was secured by a legislative mandate.

The Maine Plan aims at the lifelong process of education. Preschool, elementary, and secondary education encompasses some of the best developmental periods for

establishing positive attitudes and behaviors toward the environment. Higher education is charged with the duties of carrying out research, service, and education for the citizens of the state in all areas of public concern. At the same time, many adults who are unable to attend college still must take part in the daily environmental decisions. The Maine Plan recognizes that formal education reaches only a limited segment of the population and seeks to address this problem. The decision-making process is vital to everyone, from "the average person buying a car, to the Governor setting long range goals." This brief statement is part of Maine's rationale for environmental education (Maine State Department of Education and Cultural Services 1974).

Environmental Education, The Maryland Approach

The "Maryland Approach" is an interdisciplinary curricular framework for kindergarten through twelfth grade. As in most of the state plans, a definition of environmental education is established, goals are stated, and strategies are explained. The Maryland plan provides that an organized program of environmental studies be established as a part of the curriculum in all elementary and secondary schools of the state. The philosophy of the program encompasses four concepts. 1) It is better to restructure a program in environmental concepts and behaviors in already existing

curricula than introduce new courses or curricula. 2) Such a program should be built around the concept that young students should study the environment of the home and school. As students grow older, emphasis should shift to the community the region, and the earth. 3) All content within the framework of the curricula should consist of scientific technological, social, and aesthetic considerations. Valid environmental issues should be studied even though they may include controversial ideas. 4) Students should have an environmental learning experience and should have opportunities to work with environmental problem solving.

The organizational framework of the curriculum is constructed around three major ideas about the environment. These include: (1) the earth as a place where life exists, (2) the pursuit of life, (3) the effects of the pursuit of life on the ecosystem. The model for the development of these concepts and behaviors involves the defining of local programs in environmental education, placing environmental concepts in appropriate subject offerings, identifying environmental behaviors for different age-grade levels of learners, evaluating the extent that appropriate environmental concepts and behaviors are contained in current curricular offerings, selecting instructional materials, identifying teaching and learning strategies,

evaluating existing comprehensive environmental education programs. To restructure existing curricular areas, each subject in the present curriculum was examined from the viewpoint of environmental education. Performance objectives are given in the plan for the assessment at three different levels of competency (Maryland State Board of Education 1974).

Environmental Education in Massachusetts

Massachusetts lead the way in environmental education in the early 1960's with the signing of an act by the governor to establish the position of Conservation Education Supervisor within the Commonwealth's Department of Education. Shortly thereafter, the Board of Education appointed the Massachusetts Advisory Committee on Conservation Education (MACCE) to advise the Conservation Education Supervisor and the Commissioner of Education. In May of 1970, MACCE established a subcommittee to initiate work on the Commonwealth's commitment to environmental education. This task force was concerned with these three priorities during the first year: 1) The assessment of all environmental education programs currently in progress. 2) The needs assessment of environmental education within the Commonwealth. 3) The establishment of priorities based on this needs assessment. The Massachusetts Plan was developed

on the recommendation of the task force. It provided that "a quasi-public organization be immediately established to catalyze and focus the private and public environmental education effort in the Commonwealth." The purpose of this organization was to be multifold. Once functioning, the organization would:

> Work closely with government agencies, educational groups, community action groups, industry, and other groups and individuals to open new and productive channels of communication and cooperation.
>
> Function as an environmental education clearing house and develop and mantain a communication network able to assemble, review, and disseminate ideas in the field.
>
> Synthesize the design and testing of new materials and methods for teaching environmental education.
>
> Continue to asssess the needs of environmental education and to organize the talent and funds in developing programs to meet the needs.
>
> Assist school systems or individual schools in preparing proposals for acquiring for locally--developed environmental programs which support overall state goals. This would apply to other groups as well as public school systems.
>
> Search out new technologies for improved instruction.

Four major educational groups were examined, and a set of objectives for each group was initiated. Within the plan was a draft of proposals for the development of an environmental education act for the state. (Massachusetts Advisory Committee on Conservation's Task Force for Environmental Education 1973).

Master Plan for Environmental Education in North Carolina

Before the North Carolina Plan was initiated, a survey was was initiated, a survey was (North Carolina Department of Instruction 1971a) to determine the status of environmental education in the state. A copy of the questionnaire was mailed to each school superintendent in North Carolina requesting information about environmental education programs in the school districts. The results of this initial survey indicated that 65 of the existing 152 school districts were involved in some kind of environmental education program. In addition, the State Board of Education was mandated, by the passage of a bill in 1969, to conduct a study to determine the feasibility of including the study of the environment and natural resources in the curricula of the public schools in North Carolina. The responsibility to conduct such a study was delegated to the Division of Science Education within the Department of Public Instruction. A task force was created of persons from universities, industry, public school systems, and the general public. This task force, along with the efforts of other parties, produced a workable framework of four general objectives.

> 1) Be knowledgable about the biophysical environment and its associated socioeconomic problems. 2) Possess the values, attitudes, and competencies to make wise judgments on how to meet these problems. 3) Be motivated to work toward the solution of these problems. 4) Be committed to maintain and improve constantly that environment.

Environmental Education in the State of Oregon

The Oregon Plan (Oregon Conservation and Outdoor Education Advisory Committee 1970) in environmental education clearly points out that such programs must deal with the total environment. The utilization of the total environment is a major goal in general education within the scope of Oregon's Plan. Application of the basic skills (reading, writing, arithmetic) in a problem-solving approach will give students the motivation and competency to develop personal and group responsibility toward the social and natural environment. Thus, the Oregon Plan states that environmental education should span the total spectrum from kindergarten to adult education in order to build the necessary skills for citizens to become involved in wise environmental decision-making processes.

The Oregon Plan is made up of four major sections. One section dealing with curriculum development, involves the improvement of learning basic skills by providing experiences that allow for application of those skills in the environment and utilizing a problem-solving approach to problems in the environment. These two objectives were accomplished by publishing and distributing a state environmental education guide, developing guidelines for local school districts to use in implementing environmentally oriented programs at all grade levels,

training teams of local educators and resource people to instruct other educators in the implementation of programs at all grade levels, and providing full-time consultants to school districts for environmental program development. The second major section of the plan includes teacher training and development of guidelines for required teacher competencies in environmental education. These guidelines were met by conducting intensive teacher training workshops in various parts of the state. Finally, guidelines were developed with the System of Higher Education for establishing fifth-year programs and advanced degrees in environmental studies. A third major recommendation involved educational facilities. It was decided that a network of educational facilities should be identified for specific use in implementing and improving the total quality of educational experience for all students. Special site procurement, planning, and staff development were recommended to initiate this objective. Community education, a fourth objective, clearly stressed the need for community involvement. Courses were to be offered that involved the community in activities that resulted in an increased understanding of the environment, and man's relationship and responsibility to the environment, and a motivation to participate in environmental problem-solving, especially at the local level. Further emphasis was

directed at providing career opportunities for students interested in environmental occupations. To develop an awareness by the general public and to include them in environmental activities, courses at the college level were initiated. A final goal of the plan was to involve public support by developing and initiating a vigorous plan of action to inform and gain support for the acceptance of a state environmental education plan by key people, especially legislators, state and local officials, school superintendents, and the general voting public.

Environmental/Ecological Education in Virginia

The development of an environmental ecological education committee of the Virginia State Department of Education (1976) was focused around nine general objectives. The initial objective included the evaluation and assessment of the needs of local school divisions with regard to environmental education in all areas of the curriculum from kindergarten through grade 12. A second objective was to review the existing materials which were available to the public schools in areas of environmental/ecological education. The third objective was to review materials, surveys of local, state, regional, and national activities in the area of environmental education were undertaken. A fourth objective covered the development of appropriate

curriculum materials and publications that emphasize a state wide program in environmental education. A library of materials dealing with environmental education would be made available to the educators in local school divisions for review. Workshops and training conferences would be organized to provide local and regional educators with the input necessary to develop and improve existing programs. A seventh objective included the provision of consulting services from the Virginia State Department of Education to local school divisions interested in a program in environmental education. A network of consultants and organized workshops would be required to continue the viable state wide program. A final objective involved encouraging a broad based interdisciplinary program of environmental studies in kindergarten through grade 12.

The Virginia State Plan in environmental education was officially initiated in 1973 when the Virginia Legislature passed House Joint Resolution 198. This secured the goals and objectives of the initial environmental education plan. The general goal of the state program was to develop a desire among both children and adults to become cognitively and actively involved in the preservation and improvement of the environmental and ecological balance. Six student performance objectives were established. In summary, these were aimed at creating an awareness of the environment by

initiating an inquiry approach. This approach would teach problem-solving and decision-making skills necessary to guide one in living harmoniously with the environment. Problem identification and value clarification would also be included in the program (Virginia State Department of Education 1976).

Summary of State Plans

All of the state plans reviewed had several common goals. Awareness of the environment and the concepts of interdependence and unity of nature was the most commonly occurring goal among most of the state plans. Several state plans included curriculum changes to enhance the development of such an awareness. Others indicated that including certain concepts into the already existing curricula would be sufficient. Coupled with the acquisition of knowledge is the stimulation of creative-thinking through decision making processes. This goal was cited by almost all of the plans. Such decision making processes are essential in developing actively involved citizens. Several state plans had unique points, while several concentrated on the organizational process. Massachusetts' and Virginia's plan aimed at establishing priorities based on needs found through surveys. Oregon's plan placed an emphasis on using environmental education as a means of enhancing the basic

skills. All of the plans defined environmental education within the framework of the Environmental Education Act of 1970.

CHAPTER 3

DESIGN OF STUDY

Overview

The study involved a survey of the environmental knowledge and opinions of tenth-grade students from a random sample of public schools in Louisiana and the development of a curriculum plan based on the results of this survey. The schools included in the study were selected as suggested by Chin (1971), Perkes (1973), Bohl (1976), and Richmond (1976). Approximately 30 students within each of the schools selected were tested. The students were selected by the principal from an existing class or randomly from the student body.

The instrument used in the survey was developed by the researcher with the aid of faculty and staff from twelve departments on the Louisiana State University Baton Rouge Campus. The initial objectives developed for the inventory were selected from 19 state environmental education plans and programs. The final instrument was field tested at Baton Rouge High School and the Louisiana State University Laboratory School in Baton Rouge.

This study was endorsed by the Louisiana State Department of Education. Correspondence to each of the schools and parishes involved was conducted through the Science

Section of Louisiana State Department of Education. A letter was sent to each participating principal and to each school superintendent describing the purpose of the study.

Sample

The population for this study was defined as all of the tenth-grade students enrolled in the public secondary schools in Louisiana. The tenth grade was selected because it is considered the final year during which many students take a science course which might involve environmental concepts. Likewise, similar studies used the same grade level, allowing possible future comparisons between groups. (Perkes 1973, Eyers 1973, Bohl 1976, Richmond 1976, Kuhn 1979). Prior to the selection of the secondary schools used in the study, some method was needed to divide the state into regions. The eight state planning districts map, shown in the Louisiana School Directory 1978-1979, was found to be the best method to subdivide the state. The total number of secondary schools in each of the regions and the total number of secondary students in each region are presented in Table 1. The number of secondary schools selected from each of the eight regions was calculated on the basis of the ratio of public secondary enrollment to the total public enrollment within Louisiana. This method was adopted from Perkes (1973) and Bohl (1976). The major source of

population data for this study was found in the State Department of Education's One Hundred Twenty-Ninth Annual Report (1979). Information regarding the names of the schools and administrative officials and sizes of the schools were obtained from the Louisiana School Directory 1978-1979. Using methods from previous studies, (Perkes 1973, Bohl 1976) it was determined that about 30 tenth-grade students from 52 schools, or slightly more than ten percent of the 407 public secondary school departments in Louisiana, would adequately represent the target population. The mean number of students responding from each school was 27.4 which provided a total of 1,412 tenth-grade students from 54 schools. Responses were received from 1,412 students in 53 schools. This represented a 98 percent return rate.

A proportional, stratified randomize design was used to sample schools from the eight regions. Approximately ten percent of the total schools within a region were sampled. Figure 1 shows a flow chart of the sample selection used in this study and is similar to those used by Perkes (1973) and Bohl (1976).

Table 1

Distribution of Schools and Students Selected by Region

Region	Number of Schools	Number of Students	Percent Schools	Percent of Students Selected	Schools Selected
1	72	63,206	14.4%	23.5%	12
2	85	43,876	17.0%	16.3%	9
3	30	19,862	6.1%	7.4%	3
4	62	34,895	12.4%	13.0%	7
5	45	19,082	9.0%	7.1%	3
6	58	30,167	11.6%	11.2%	6
7	84	37,150	16.8%	13.8%	8
8	63	20,475	12.6%	7.6%	4
TOTAL	407	268,670	100.00	100.00	53

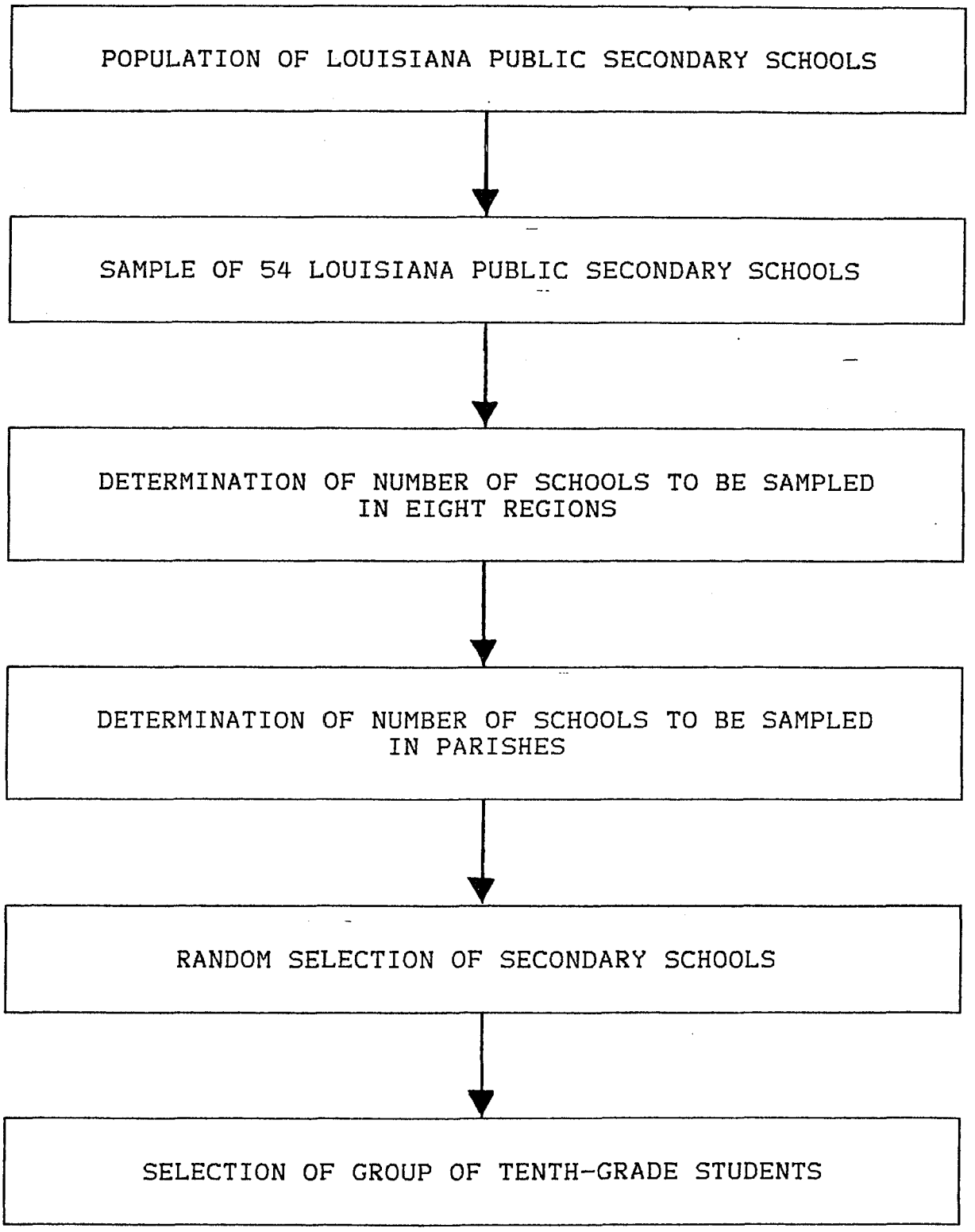

Figure 1: Flow Chart of the Sampling Design.

Instrument

A review of state plans, legislation, and literature in conservation and environmental education from other states yielded 134 general objectives. The objectives were reviewed by a panel of 35 faculty and staff members in 12 departments of the Louisiana State University at Baton Rouge. Several broad categories of environmental concern were identified as (1) population, (2) energy, (3) resource use, (4) basic ecological principles, and (5) pollution.

Development of Cognitive Questions

The objectives for this study were written in a general objective format at the highest possible cognitive level. Thirty-five faculty and staff members were asked to assess their validity and to rate them according to what they felt was most important for high school students to know about the environment. Each participant was told of the interest by the Louisiana State State Department of Education in developing a curriculum plan for environmental education. All of those potential panel members who were contacted agreed to participate. The objectives were listed according to category and subject area, along with a Likert-type scale for each objective. The participant was asked if he "strongly agreed," "agreed," felt "neutral," "disagreed," "strongly disagreed," or had "no opinion" about each of the

objectives regarding its inclusion in a curriculum of environmental education for high school students. Twenty-five of the 35 individuals responded to the survey within the alloted time of four weeks; however, in order to reduce the discipline bias in the selection of the objectives for the instrument, only the earliest received response from each of the 12 departments in the survey was selected. The departments represented are listed in Table 2. The objectives were tabulated by frequency and percent. Of the 134 objectives, 43 were selected to form the basis for the cognitive portion of the instrument used in the survey. The selection of the objectives was based on the criteria that it was rated at least 50 percent as "strongly agree" and/or 80 percent as "agree" and "strongly agree" combined. The categories of "no opinion" or "neutral" had no effect on the selection process.

Development of Affective Questions

Since attitudes and opinions were essential in this study, it was necessary to develop objectives that involved the affective domain. Fifteen questions were developed from the cognitive objectives to measure the students' attitudes toward special problems in the environment. The questions were cross-referenced with the cognitive objectives. Five additional questions asked the student to select from a list the environmental problems which he/she perceived as the

most serious in the community, state, nation, and world. Another question relating to the source of environmental knowledge was aimed at determining where the students obtained most of their environmental knowledge. A final question asked the students if they belonged to any organizations that have environmental programs.

Table 2

Departments Represented in the Instrument Development

Department	Number of Faculty Participating	Number Selected
Botany	2	1
Chemistry	4	1
Economics	1	1
Education	4	1
Engineering	2	1
Entomology	3	1
Forestry	1	1
Marine Science	5	1
Nuclear Science	3	1
Sociology	2	1
Wildlife & Fisheries	2	1
Zoology	6	1
TOTAL	35	12

Pilot Study

Pilot testing of the instrument was conducted at the Louisiana State University Laboratory School and Baton Rouge High School. Two classes were tested at the Louisiana State University Laboratory School and four classes at Baton Rouge High School. In each pilot test a group of tenth-grade students participated. In addition, two classes of approximately 20 ninth-grade students examined the instrument to check its readability and to locate errors. The students were encouraged to identify areas of the instrument that they did not understand. A second group of 16 twelfth-grade students also examined the instrument to determine its readability.

Using the data obtained from the pilot testing of the instrument, the reliability was determined by using a rationale equivalence reliability formula devised by Kuder and Richardson (Van Dalen 1979). Using the KR21 formula, the reliabilty estimate value was calculated at .96. A copy of the instrument used in the study is in Appendix A.

Data Collection and Analysis

Approximately 2,000 copies of the instrument were printed by the Louisiana State Department of Education. Fifty-two packages of test materials were assembled; each packet contained 30 instruments and answer sheets. Special

answer sheets were required by the Louisiana State University Testing Service for use in an optical scanner. Also included was a letter describing the procedure for administering the instrument, a copy of an answer sheet showing where the information was to be coded, and a self-addressed envelope. The instructions indicated that the instruments and answer sheets were to be returned to Donald McGehee, Science Section, Louisiana State Department of Education, Baton Rouge, Louisiana. This return address assured the participants of the sponsorship of the State Department of Education.

The data were collected during a three month period from March 15, 1980 to June 15, 1980. The data were transfered to computer tape and disk from optically scored answer sheets. The data were then analyzed using Statistical Analysis System programs (Barr et.al. 1979).

The inventories were analyzed by examining frequency distributions of responses and conducting analyses of variance on the mean of the knowledge variables, mean scores of the five categories: 1) general ecology, 2) population, 3) resource, 4) energy, and 5) pollution variables, and each of the knowledge variables by state, region, sex, urban or rural community and size of school.

Definition of Terms

Environment - The environment is defined as all of the surrounding conditions and influences that affect an organism. In this study an emphasis is placed on those aspects that are unique to human development. As indicated by Richmond and Morgan (1977), environmental components include natural resources, population, pollution, land use, environmental health and safety, ecological relationships, and social/political and economic influences.

Environmental Education - Environmental education is defined as the process of developing knowledge, understanding, attitudes, and responsibility with regard to man's relationship to his sociocultural and biophysical surroundings.

Region of School - The eight geographical regions defined by the Governor's Council.

Rural Schools - Rural schools are defined as schools that are in communities of less than 5,000 people.

Urban Schools - Urban schools are defined as those located in communities with a population greater than 5,000.

Size of Schools - The schools surveyed were subdivided into four sizes based on the number of secondary students enrolled. This division includes: Small schools

containing 100-499 students, medium-small schools containing 500-999 students, medium-large schools containing 1000-1499 students, and large schools containing 1500-3000 students.

Delimitations of the Study

This study was conducted utilizing only public schools in the State of Louisiana. Only secondary students in the tenth-grade were selected.

CHAPTER 4

RESULTS AND DISCUSSION

Introduction

An analysis and discussion of the data is presented in this chapter in both descriptive and tabular form. The discussion is presented under the following headings: Response Rate; Discussion of Students Responses; Summary.

Response Rate

The population consisted of 407 public secondary schools in in Louisiana (Louisiana State Department of Education 1980). A total of 54 schools were selected and sampled from eight regions within the state. The 54 schools represented about 13 percent of the total number of secondary schools. The student population of 1,412 represented 0.56 percent of the 251,898 secondary students. Table 3 shows the number of schools and number of students participating from each region. Fifty-three schools administered the inventories and returned the answer sheets prior to June 15, 1980. The schools responding represented 98 percent of the original sample.

Table 3

Number of Schools and Students Participating By Region

Region	Number of Schools Participating	Number of Students Participating	Total Percentage of Students Participating
1	12	368	26
2	10	251	18
3	3	77	5
4	6	134	10
5	3	92	7
6	6	147	10
7	8	216	15
8	5	127	9
Total	53	1412	100%

Sex Distribution of Students

Fewer males were represented in the study than females. Approximately 59 percent of the students participating in the study were female, and slightly over 40 percent of the respondents were male. Appendix B shows the number of students by sex within each region. Urban schools had a higher percentage of female students with 59 percent, while rural schoolshad 54 percent. However, rural schools had a higher percentage of males with 46 percent, while urban schools had 41 percent. Appendix C shows the frequency distribution of students within urban or rural schools by sex.

Age Distribution of Students

The age distribution of the students participating included 45 percent who were 15 years of age, 40 percent who were 16 years old, approximately eight percent who were 17, three percent who were 18, and one percent who were 14 years of age.

Discussion of Student Responses

The student responses consisted of 43 cognitive variables and 20 affective variables. The responses to these variables are discussed by state total responses. An analysis of variance was conducted to determine if there

were any significant differences among regions, between sex of the students, between urban rural communities, and among sizes of school. Because the cognitive section of the instrument was based on specific objectives, some criterion was needed to establish whether the students knew the the concept. A 70 percent correct response rate was selected as an appropriate level to indicate if the students understood the concepts presented.

Descriptive Analysis of Cognitive Variables

Forty-three questions were included in the cognitive section of the instrument. The mean score for all of the students responding was 19.6 or 46 percent. These questions were grouped into five basic categories: General Ecology, Population, Energy, Resources, and Pollution. The following subsections present the results of each question within its category along with the mean score. Table 4 shows the percentage of responses to the knowledge variables for all students statewide. The names of the variables are listed in order of the questions on the inventory. Appendix A shows a copy of the instrument used in the study.

Table 4
Percentage of Responses to Knowledge Variables

Variable Name	N	Correct Response	Selected Responses A	B	C	D	E	No Response
Population Crisis	1409	C	7	55	17	20	.	< 1
Bio-Capacity	1401	A	35	13	18	34	.	< 1
Population Increase	1403	E	2	7	26	21	44	< 1
Population & Resources	1405	A	70	13	6	10	.	< 1
Ocean Pollution	1400	B	25	24	24	27	.	< 1
Aquatic Pollution	1384	D	8	18	3	68	.	< 1
Non-renewable Resources	1401	E	17	8	35	9	31	< 1
Soil Productivity	1404	B	10	58	24	7	.	< 1
Green Plant Factors	1403	A	49	19	20	11	.	< 1
Interdependence	1394	A	54	15	11	18	.	< 1
Particle Pollution	1399	B	3	22	10	45	.	< 1
Oxygen Source	1405	C	8	28	31	32	.	< 1
Wood Shortage	1405	C	41	6	44	8	.	< 1
Wildlife	1408	D	11	5	25	56	.	< 1
Wetlands	1405	C	26	46	18	9	.	< 1
Affects of Fossil Fuel	1396	A	49	10	9	30	.	< 1
Air Pollution	1406	D	3	8	8	81	.	< 1
Energy & Food	1407	A	28	24	6	41	.	< 1
Energy Source	1405	C	29	14	54	2	.	< 1
Least Polluting Energy	1405	B	46	32	14	8	.	< 1

(Table 4 continued)

Variable Name	N	Correct Response	Selected Responses A	B	C	D	E	No Response
Fossil Fuel Used	1404	C	27	39	30	4	.	< 1
Major Source of Energy	1396	C	18	36	42	20	.	< 1
Photosynthesis Product	1404	B	34	39	13	13	.	< 1
Food Web	1404	A	56	8	18	18	.	< 1
Role of Plants	1411	D	17	11	5	26	41	< 1
Temperature Change	1401	B	22	60	11	70	.	< 1
Agri-Water Problems	1399	B	22	46	19	12	.	< 1
Cause of Extinction	1396	B	12	52	11	24	.	< 1
Environmental Cycles	1401	B	15	44	16	24	.	< 1
Finite Resources	1403	B	6	42	25	26	.	< 1
Noise Damage	1407	D	9	13	9	64	.	< 1
Pesticides	1398	C	9	8	76	9	.	< 1
Hunting	1400	B	17	40	16	26	.	< 1
Population Limits	1399	C	14	11	41	33	.	< 1
Source of Air Pollution	1405	E	2	14	5	5	73	< 1
Erosion	1400	A	52	24	11	11	.	< 1
Earth's Capacity	1405	C	4	12	76	7	.	< 1
Population Level	1394	B	33	31	24	11	.	< 1
Sewage Effects	1406	D	4	5	19	67	5	< 1
Fresh Water Problems	1400	C	44	5	44	7	.	< 1
Noise Problems	1412	C	12	4	64	20	.	< 1
Recreation Use	1401	D	11	17	13	58	.	< 1
Recreational Limits	1400	B	26	20	26	28	.	< 1

General Ecology Variables

General ecological principles are essential to the understanding of basic environmental science. These principles involve basic biological and physical science concepts. There are nine questions that specifically dealt with general ecological concepts. Within this area, the mean score was 4.1 or 46 percent. These results indicate that the students are aware of some ecological concepts but fewer than one-half of the students consistently responded correctly to these cognitive variables. Table 5 indicates the distribution of responses by percentage for each general ecology question.

Approximately 49 percent of the students understood that "water and carbon dioxide in the presence of sunlight affect growth in green plants." This very basic biological principle is essential in understanding the major sources of energy for mankind since plants supply most of the food in the world to animals.

Over 54 percent agreed that living things are interdependent with one another and their environment. Linking interdependence with green plants, the students were asked where most of the oxygen in the atmosphere comes from. Twenty-seven percent thought oxygen comes mainly from the forests around the world, while 30 percent correctly felt that both algae and forest contribute to most of the world's

Table 5

Percentage of Responses to General Ecology Variables

			Selected Responses					
Variable Name	N	Correct Response	A	B	C	D	E	No Response
Photosynthesis Product	1404	B	34	39	13	13	.	< 1
Green Plant Factors	1403	A	49	19	20	11	.	< 1
Interdependence	1394	A	54	15	11	18	.	< 1
Oxygen Source	1405	C	8	28	31	32	.	< 1
Food Web	1404	A	56	8	18	18	.	< 1
Role of Plants	1411	D	17	11	5	26	41	< 1
Temperature Change	1401	B	22	60	11	70	.	< 1
Cause of Extinction	1396	B	12	52	11	24	.	< 1
Environmental Cycles	1401	B	15	44	16	24	.	< 1

oxygen supply. However, over 32 percent selected "none of the above," which indicated that a large number of the students did not understand this concept. When asked, "what is a major by-product of photosynthesis," 39 percent answered that oxygen was produced, while 34 percent indicated that carbon dioxide was produced. These results show that most of the students did not understand the importance of plants in the environment.

When asked about the function of food webs, 52 percent agreed that all living things fit into a food web. Only eight percent indicated that the statement was false. Seventeen percent did not know and another 17 percent indicated that only some things fit into a food web. When asked about the role plants play in an ecosystem, 26 percent of the students selected all of the responses, while 42 percent indicated that plants both "purify the air" and "provide cover to hold the soil in place." Over 62 percent (including those answering only "purify the air" or "provide a cover to hold soil") did not understand that plants act to protect the water supply.

When asked if a change in the world's temperature would affect the the world's climate, 60 percent agreed that it would alter the climate. Twenty-two percent indicated that it would not affect the world climate. This suggests that a large percentage of students are not aware of the critical balance in the earth's temperature.

Approximately 40 percent agreed that hunting was man's way of controlling animal populations that would otherwise be removed naturally. Twenty-six percent selected "none of the above," indicating that they did not understand the role of hunting. In all, over 42 percent did not recognize hunting as a means of controlling animal populations.

When asked on what the continuation of life depended, 44 percent of the students responded that it depended on a cyclic flow of materials between organisms and their environments. Continual use of raw materials was accepted by 24 percent of the students as the correct answer, indicating that they did not comprehend the concepts related to the flow of energy and matter in an ecosystem.

Population Variables

Population issues are regarded as one of the most difficult areas to assess, since many "value judgments" are involved in the concept of population control. Population is part of the basic ecological concepts, but for purposes of this study, it is treated separately. The mean score for the population variables across the state was 2.4 or 35 percent. The distribution of students by percentage selecting each answer for the population questions are shown in Table 6. The students showed a considerable awareness of population problems and the effects of a growing population

Table 6

Percentage of Responses to Population Variables

			Selected Responses					
Variable Name	N	Correct Response	A	B	C	D	E	No Response
Population Crisis	1409	C	7	55	17	20	.	< 1
Bio-Capacity	1401	A	35	13	18	34	.	< 1
Population Increase	1403	E	2	7	26	21	44	< 1
Population & Resources	1405	A	70	13	6	10	.	< 1
Population Limits	1399	C	14	11	41	33	.	< 1
Earth's Capacity	1405	C	4	12	76	7	.	< 1
Population Level	1394	B	33	31	24	11	.	< 1

on the world but failed to recognize this growth as a major world environmental problem.

Many of the cognitive items may have been affected by current national and world events. Over half of the students surveyed indicated that the energy shortage was the most critical. Twenty percent of the students responding stated that the threat of war was the greatest crisis, and approximately seven percent felt that food is the most pressing problem. The correct answer is increasing population, to which 17 percent agreed. Increasing population is cited as the most serious problem in the world today by Ehrlich and Ehrlich (1978), Odum (1976), and Newsom (1979).

Another question dealing with the concept of population dynamics was aimed at determining whether the students understood the idea that man or any organism has the innate capacity to reproduce beyond the availability of resources. Over 35 percent agreed; however, 34 percent selected "all of the above," and 18 percent selected "reproducing without limits"-- which indicates an unawareness of biological capacity or limits of a population. A large percentage of students were aware of some of the reasons that the world population is increasing despite the reduction of the birth rate. Forty-four percent answered that the overall increase of the world's population has been attributed to more

available food and better health care. Twenty-one percent agreed but included "less war" in this list by selecting "all of the above." Twenty-five percent selected "better health care" only. When asked what effect an increasing population has on resources, 70 percent of the students indicated that they would be depleted at a greater rate.

Three questions were aimed at factors that affect populations. One question asked the students to select a major limiting factor of populations. Forty-one percent choose food as a major limiting factor, and 33 percent selected space. Both fossil fuel and shelter were selected by 26 percent of the students. A similar question asked whether the earth has a limited capacity to maintain life. Seventy-six percent agreed that all species, including man, are limited. When asked what determines the population level of an organism, 31 percent of the students correctly answered "available materials and conditions necessary for maintaining life." Thirty-three percent selected "available food and space necessary for maintaining life," a similar answer that does not include total environmental features. Twenty-four percent indicated that "reproductive rates affect the population level."

Resource Variables

Resource use has a vital effect on an ecosystem. The awareness and knowledge associated with resources and resource use are essential in understanding every aspect of the environment. The mean score for these variables was 3.4 or 43 percent. Table 7 shows percentage distribution of responses selected by the students for the resource variables.

Thirty-one percent of the students were able to identify correctly examples of non-renewable resources. Another 35 percent selected only minerals, and eight percent selected iron and copper. When asked what the term "finite" means as it applies to natural resources, 25 percent responded correctly that it is a limited supply of non-renewable resources. These results suggest that very few of the students understood the different types of resources and their limits.

Approximately 44 percent agreed that recycling more paper products would aid in reducing a shortage of wood and wood products, and 41 percent indicated that planting more trees would be the best method in handling a shortage. Both of these responses are correct; however, a more positive environmental response would favor any form of conservation measure over increased productivity. Overall, the students appear to be aware of certain alternatives that are available for this renewable resource.

Table 7

Percentage of Responses to Resource Variables

Variable Name	N	Correct Response	Selected Responses A	B	C	D	E	No Response
Erosion	1400	A	52	24	11	11	.	< 1
Non-renewable Resources	1401	E	17	8	35	9	31	< 1
Soil Productivity	1404	B	10	58	24	7	.	< 1
Wood Shortage	1405	C	41	6	44	8	.	< 1
Wildlife	1408	D	11	5	25	56	.	< 1
Wetlands	1405	C	26	46	18	9	.	< 1
Finite Resources	1403	B	6	42	25	26	.	< 1
Hunting	1400	B	17	40	16	26	.	< 1

When asked about the importance of wildlife populations, over 56 percent answered that they are economically, aesthetically, and biologically important. Most selected one or more of the options provided, indicating that they are aware that wildlife are important. However, many of the students did not interconnect all of the options.

A major question concerning Louisiana was, "Where is the most economically and biologically productive region of the State?" Forty-six percent indicated that agricultural lands are the most productive, 26 percent indicated that forested lands are most productive, while 18 percent selected wetlands as the most productive areas. These data suggest that the students are aware of the value and importance of agricultural lands and forests, but are uninformed about the value of Louisiana's wetlands.

Two questions relating to soil productivity and erosion were included in the instrument. When asked which soil type is the most productive, 58 percent said that soils with high levels of organic content are most productive. This indicates that a large percentage (42 percent) of the students did not understand the importance that detritus plays in providing biological productivity. When asked about the rate of soil erosion, 53 percent indicated that soil is being lost at a greater rate than it is being

replaced. Even though most of the students are aware of the problems associated with soil erosion, a large percentage (47 percent) do not know about this conservation problem.

Energy Variables

Energy and energy use is one of the greatest issues of this century. The mean score for the energy variables was 2.3 or 39 percent. Table 8 shows the percentage of responses selected by the students statewide for the energy questions.

One of the main concepts often neglected in science education is that of energy dynamics and energy flow within an ecosystem. One question addressed this concept. The students were asked about the impact energy has on agricultural systems. When asked why an increase in the cost of energy affects the cost of food production, 27 percent of the students indicated correctly that modern fertilizers require energy for their production. Almost 25 percent thought that it is due to an increase in farm labor cost, while 41 percent indicated that less energy would be available to farmers causing the price of energy to go up. The data indicates that the students do not understand the impact fertilizers have made on the farming industry, or the energy relationship with food production.

Table 8

Percentage of Responses to Energy Variables

		Selected Responses					
Variable Name	N	Correct Response	A	B	C	D	E	No Response
Affects of Fossil Fuel	1396	A	49	10	9	30	.	< 1
Energy & Food	1407	A	28	24	6	41	.	< 1
Energy Source	1405	C	29	14	54	2	.	< 1
Least Polluting Energy	1405	B	46	32	14	8	.	< 1
Fossil Fuel Used	1404	C	27	39	30	4	.	< 1
Major Source of Energy	1396	C	18	36	42	20	.	< 1

When asked to select from a list of possible energy sources, all of which are actual sources of energy, 54 percent selected all of the items in the list. These included the sun, wind, tides, and the atom. Twenty-nine percent selected only the sun and wind, and 15 percent selected the sun, wind, and tides. Overall, 46 percent of the students did not consider atomic power, which suggests that they did not understand how nuclear energy is tapped.

From a list of four energy sources, the students were to select which were the least polluting. Forty-seven percent of the respondents selected nuclear energy. Thirty-two percent correctly selected the "burning of natural gas," and 13 percent selected the "burning of coal" as the least polluting of the energy sources. A majority of the students did not understand that, even though nuclear energy is a clean energy source, radioactive wastes are a major pollutant. In addition, the data indicate that the students were aware of nuclear energy as a viable energy source but failed to connect this concept with the previous question about sources of energy. Over 42 percent of the students understood that the major source of food, clothing, shelter, and energy in all societies is plant life. Almost 29 percent of the students thought that fossil fuel was the major source, and 15 percent selected oil and gas. Both fossil fuels and oil and gas are seemingly correct for

Western societies, however, they are not correct for all societies.

When asked what percentage of energy is supplied by fossil fuels in the United States, over 66 percent underestimated the total amount of fossil fuels used. Less than one-third of the students knew that 80 percent of the energy used in the United States came from fossil fuels. These results indicate that a majority of the students are not aware of the dependency on fossil fuel of the United State economic system.

One question relating to fossil fuel pollution was included with the energy questions. The students were asked, "How can the burning of fossil fuels affect the environment?" Approximately 50 percent agreed that it could change the composition of the atmosphere. Thirty percent disagreed with all of the possible answers and selected "none of the above." Even though a slight majority of the students realized the effects of burning fossil fuels, a large number indicated that they did not know about certain problems associated with combustion.

Pollution Variables

Pollution problems are of great concern to most citizens since they are often more evident than other environmental problems.

Table 9

Percentage of Answers Selected By Students
for Pollution Variables

		Selected Responses						
Variable Name	N	Correct Response	A	B	C	D	E	No Response
Source of Air Pollution	1405	E	2	14	5	5	73	< 1
Ocean Pollution	1400	B	25	24	24	27	.	< 1
Aquatic Pollution	1384	D	8	18	3	68	.	< 1
Agri-Water Problems	1399	B	22	46	19	12	.	< 1
Particle Pollution	1399	B	3	22	10	45	.	< 1
Air Pollution	1406	D	3	8	8	81	.	< 1
Noise Damage	1407	D	9	13	9	64	.	< 1
Pesticides	1398	C	9	8	76	9	.	< 1
Sewage Effects	1406	D	4	5	19	67	5	< 1
Fresh Water Problems	1400	C	44	5	44	7	.	< 1
Noise Problems	1412	C	12	4	64	20	.	< 1
Recreation Use	1401	D	11	17	13	58	.	< 1
Recreational Limits	1400	B	26	20	26	28	.	< 1

The mean score for the pollution variables was 6.6 or 51 percent. Table 9 shows the percentage of students selecting each of the possible answers for the pollution variables. The pollution questions were divided into the various categories.

Three questions dealing with water pollution included world-wide problems, national and state problems, and local problems. When asked, "What is the final dumping place for most pollutants?" each of the responses were selected approximately at the same frequency. Twenty-five percent of the students selected the "atmosphere", 24 percent selected "ocean", 24 percent selected "soil", and 27 percent selected "rivers." The most correct response was "ocean." These results show that the students do not comprehend the water cycle and how pollution affects it. A question relating to agricultural problems asked how some agricultural activities might affect aquatic ecosystems. Almost 47 percent agreed that certain agricultural activities deteriorate the quality of water in some areas. Twenty-two percent responded that some agricultural activities improve streams and rivers, while 12 percent indicated that they often improve lakes. The responses to this question may all appear to be correct, however, many agricultrural actitives add organic materials and other chemicals into the watershed which often pollute streams and rivers. When asked what might affect the amount

and quality of fresh water, 44 percent selected "pollution" as the major factor affecting fresh water.

Six questions dealing with air pollution were included in the instrument. When asked, "What effect does particle pollution have on the atmosphere?" 22 percent answered that such pollution would decrease the earth's temperature and change the climate. Twenty-three percent indicated that particle pollution would increase the earth's temperature and likewise change the climate. Forty-five percent selected "none of the above." These results indicate that the students do not know basic meteorological principles that explain how environmental factors might affect the climate. In a similar question, the students were asked how air pollution affects the environment. Almost 82 percent agreed that it causes a number of problems which affect plants and animals and hastens the deterioration of metal, brick, and cement. When asked to select from a list of possible sources of air pollution, 74 percent of the students indicated that all of the sources listed were sources of air pollution. Together, the results of these questions signify that the students are aware of air pollution and the direct effects it has on living and non-living materials.

Two questions dealing with noise pollution were included in the survey. One asked "What effects would too

much noise have on an individual?" Sixty-four percent responded that too much noise can be physically, mentally, and emotionally harmful. When asked in what area is noise pollution an increasing problem, 64 percent indicated that problems with noise would most probably occur in a "growing industrial nation." In this question, the students showed an awareness of problems associated with noise pollution and where such pollution would probably be the greatest.

Two questions pertaining to recreation and land-use yielded consistent results. Nearly 59 percent of the respondents selected "all of the above" which included land management problems, costing the taxpayer money, and causing a reduction of interest in recreational areas affected. When asked what can limit recreational facilities and/or activities, the students responded almost equally to all of the answers. Over one-forth of the students indicated reduced interest, while one-fifth of the students selected pollution. Twenty-five percent of the students indicated that space was a major limiting factor; approximately 28 percent of the students believed crime was the major factor. Pollution was the most correct response for this variable.

Discussion of Affective Variables

The affective questions had no correct answers, yet the responses indicated if the students had environmentally

favorable opinions about certain environmental issues. Twenty questions were included in this section of the instrument. Fifteen of these had Likert-type responses of "agree," "neutral," "disagree," or "no opinion." Five remaining questions dealing with particular environmental problems of the community, state, nation, and world are discussed separately. Table 10 shows the percentage of responses for the first 15 affective variables.

General Questions

One statement implied that the concern about environmental problems had been over-exaggerated. Forty-nine percent of the students disagreed with the statement, 20 percent were neutral, and 14 percent had no opinion. However, 15 percent thought that environmental problems had been over-exaggerated.

Another statement suggested that the most important thing to consider about bringing industry into an area is the number of jobs it will create; 35 percent agreed, while 37 percent disagreed. Nineteen percent felt neutral about the issue, and eight percent had no opinion about the effect it could have.

Views on resource-planning were examined by asking the students if management of natural resources was to meet the needs of successive generations, would it demand long-range

Table 10

Opinions About the Environment

	Percentage Responding			
Affective Variable	Agree	Neutral	Disagree	No Opinion
Population Planning	56	16	15	13
Relax Restrictions	29	25	28	18
Land Use	52	19	16	12
International Rationing	43	22	24	11
Enforce Recycling	59	16	13	10
Economic Values	35	19	37	9
Environmental Exaggeration	15	20	48	14
Government Control	38	14	36	11
Individual Life Style	2	15	61	11
Environmental Protection	42	23	20	14
Individual Freedom	20	24	40	15
Resource Dependency	8	19	3	68
Long-range Planning	58	18	10	13
Environmental Concern	36	18	32	12
Needs and Wants	72	11	7	8

planning. Fifty-eight percent agreed with the statement, and approximately ten percent disagreed. Eighteen percent of the students indicated that they were neutral on the issue; 13 percent had no opinion.

Several questions were directed at population problems and the effects of increasing population. Fifty-six percent of the students believed that planning which will limit the size of families is important if over-population is to be avoided. Less than one percent felt that such planning was not necessary. However, 43 percent selected "no opinion." Another question aimed at population issues asked the students if it is more important to preserve freedom of the individual than to enforce laws to protect the quality of life in the future. Nearly 41 percent of the respondents disagreed. Twenty-four percent selected "neutral," and another 15 percent had "no opinion." Almost 20 percent believed that it was more important to preserve one's freedom, showing that some students valued "freedom" more than "quality of life." A closely related statement, "an individual has too much power in determining the way he lives," yielded 62 percent disagreeing and 12 percent agreeing. Fifteen percent remained neutral, and approximately 11 percent had no opinion. The majority of the students felt that individuals do not have enough control in determining the way they live. This response

rate may reflect the general opinion adolescents have towards homelife, school, or anything that might reduce their personal freedom.

When asked if restrictions that hinder energy production should be relaxed, almost 29 percent indicated that they should be. Twenty-eight percent believed that such restrictions should not be relaxed. Approximately 25 percent of the students felt neutral about the issue, and 18 percent had no opinion. A similar statement suggested that only strong government controls would reduce pollution problems. Thirty-nine percent agreed that government controls were the best alternative, and 36 percent disagreed. A third statement asserted that controls should be placed on industry which will protect the environment even if it means goods will cost more. Forty-two percent of the respondents believed that such controls should be inplemented despite cost increase. Twenty percent did not agree with the statement, and a total of 30 percent of the students had either no opinion or felt neutral about the issue. Another question aimed at industry stated that industries should be encouraged to use recycled materials even if it costs less to make the same product from raw materials. Almost two-thirds (60 percent) were in favor of such a recycling policy. Thirteen percent disagreed with the concept. Government control was believed by many

students to be a remedy for certain environmental problems, especially where conservation measures were suggested.

Almost 43 percent of the students favored international control over fossil fuels and the development of some fair method of allocating resource use. Twenty-four percent were not in favor of such a policy. The fact that many students favored international control-such as rationing indicates - that they realized the limits individual nations have in solving global environmental problems, especially those associated with resource allocation.

When asked if a national land use policy should be implemented, 52 percent of the students agreed. Sixteen percent of the students disagreed with the idea, and 19 percent remained neutral. Twelve percent of the students had no opinion regarding this issue. The wide acceptance of a national land-use policy implies that many students are aware and concerned about uncontrolled growth and development that destroys much of the biologically productive and aesthetically pleasing areas.

A general question asked if the continued political and economic strength of a country is dependent upon the natural resources to which it has access. Sixty-eight percent had no opinion, and eight percent of the students agreed. Approximately three percent disagreed with the concept. These opinions reflect a of awareness that resources are

vital in providing economic and political security to a nation.

Thirty-six percent of the students believed that people who live in the suburbs are generally more concerned about environmental matters than people who live in rural areas. Thirty-three percent of the students disagreed. These results suggest that the students are evenly divided over where people live who are more concerned about the environment.

Seventy-three percent of the students thought that choices between human needs and human wants must be considered if we are to improve the quality of life. The students seemed to be aware that certain wants must be adjusted for basic needs.

Serious Environmental Problems

Five questions were directed at determining what the students believed was the most serious problem in the community, the state, the nation and the world.

Community Problems. Community problems consisted of five problem areas that are common in many communities throughout Louisiana. Twenty-six percent of the students believed that waste disposal is the most serious serious problem in their community, followed by crime at 21 percent.

Land-use problems ranked third at 20 percent; air and water pollution were selected by 18 percent, and traffic problems by 18 percent of the students as the most serious environmental problems. Table 11 shows how students responded to this question.

Table 11

Serious Community, State, and National Problems Selected by Students

Problem Area	Percentage of Responses Community (1393)	State (1395)	Nation (1385)
Land Use	20	14	8
Traffic	13	---	---
Air and Water	18	18	29
Waste Disposal	27	24	11
Crime	22	30	43
Public Health	----	14	8
No Response	1	1	2

State Problems. The most often selected state problem, with a 28 percent response, was crime. Twenty-three percent selected waste disposal.

Air and water pollution was chosen by 18 percent of the students, and 15 percent indicated that public health is the most serious problem. Fourteen percent named land use. Table 11 shows the percentage of students selecting each problem area.

National Problems (first set). The serious environmental problem in the United States was divided into two categories. In the first group, 41 percent of the respondents selected "crime" as the most serious problem in the United States. "Air and water pollution" was selected by 29 percent of the students, and 11 percent indicated that "waste disposal" was the most serious issue confronting the United States. Eight percent of the students selected both "land use" and "public health." Table 11 shows the way in which students responded to each problem.

National Problems (second set). The second category included all new responses. Thirty-nine percent of students believed that energy and resource waste is the most serious national problem. War was selected by 24 percent of the students. "Lack of energy" was believed by 19 percent to be the serious problem. "Education and poverty" were selected by less than 15 percent of the respondents. Table 12 shows the students' responses to the question.

Table 12

National Problems Selected By Students

Problem	N	Percent Responding
Threat of War	345	25
Poverty	91	6
Lack of Energy	265	19
Energy/Resource Waste	551	39
Education	126	9
No Response	34	2
Total	1412	100

World Problems. When asked what is the most serious "world problem," almost 43 percent felt that "poverty and hunger" are the most pressing issues in the world. Nineteen percent selected "war" as a major problem; "energy" and "population" were selected by 16 and 15 percent of the students respectively. Pollution was regarded as the most serious problem by approximately five percent. Table 13 lists the percentage of students choosing each of the problem areas.

Table 13

World Problems Selected by Students

Problem	N	Percent Responding
Poverty and Hunger	596	42
Population	213	15
Energy	226	16
War	273	19
Pollution	64	5
No Response	40	2
Total	1412	100

Analysis of Data

The cognitive variables were analyzed to determine if there were any significant differences among regions, between sexes, between community type, and among size of school. Analyses of the various categories of the cognitive variables were also conducted.

Cognitive Variables

The mean score for the cognitive variables was 19.6 or 43 percent. The eight planning regions of Louisiana geographically subdivide the state. Statistical analyses were conducted on these data to determine if there were

significant differences among regions. The data revealed a significant difference among the means of the regions at the .0001 level for the cognitive variables. Using Duncan's Multiple Range Test, (Barr et. al. 1979), significant differences were found among the mean scores of Alexandria-Central and Houma-Thibodaux Regions, and those from Orleans. Alexandria-Central Region had the highest score with 20.8 questions correct or 48 percent, and Houma-Thibodaux Region had 20.5 questions correct or 48 percent. The Orleans Region had the lowest score with 18.4 or 43 percent of the questions correct. The schools surveyed were subdivided into four sizes based on the number of secondary students enrolled. This division included: small schools containing 100-499 students, medium-small schools containing 500-999 students, medium-large schools containing 1000-1499 students, and large schools containing 1500-3000 students. The data revealed that there were significant differences at the .0001 level among the mean scores of the various school sizes on the cognitive variables. Using Duncan's Multiple Range Test, it was found that large schools scored signifcantly higher with a mean of 21.5 or 50 percent, and medium-large and medium-small schools scored significantly lower. Medium-small schools had a mean score of 19.8 or 46 percent for the cognitive variables, while medium-large schools had a mean score of 19.4 or 45 percent. No significant differences were found

among medium-large or medium-small schools, however, small schools scored significantly lower than either of the other school sizes, with a score of 18.5 or 43 percent, There were no significant differences between the scores of male or female students (46 percent) and there were no significant differences between the scores of the urban (48 percent) and rural students (44 percent). Table 14 shows the mean scores in percentage by region for each of the cognitive categories. Table 15 shows the mean scores in percentage by sex, community type, and size of schools for each of the cognitive categories. Table 16 shows an analysis of variance for the knowledge scores. Appendix D shows the percentage of students responding to the cognitive variables by region, sex, type of community, and size of school.

General Ecology Variables. The mean score for the nine general ecology variables was 4.1 or 46 percent. Male students scored slightly higher than female students on questions relating to general ecology. Approximately 47 percent of the males responded correctly, with a mean score of 4.2. Forty-four percent of the females answered accurately with a mean score of 4.0. Significant differences between the mean scores of males and females were found for the general ecology variables at the .015 level). Large schools had the highest mean scores with 4.5 or 44 percent. Medium-large and medium-small schools had mean scores of 4.1.

Table 14

Mean Scores For All Regions and State With Rank

Region	Ecology	Rank	Population	Rank	Resources	Rank	Energy	Rank	Pollution	Rank	Mean	Rank
1	46	3.5	35	4.0	44	2.0	39	4.5	50	6.0	46	3.5
2	45	5.5	35	4.0	43	4.5	39	4.5	50	6.0	45	5.5
3	48	2.0	36	2.0	45	1.0	41	1.0	53	2.0	48	1.5
4	45	5.5	34	6.5	43	4.5	40	6.5	50	6.0	45	5.5
5	42	6.5	32	8.0	43	4.5	38	6.5	51	4.0	44	7.0
6	49	1.0	38	1.0	43	4.5	37	8.0	56	1.0	48	1.5
7	46	3.5	35	4.5	41	7.0	40	2.5	52	3.0	46	3.5
8	42	6.5	34	6.5	36	8.0	38	6.5	50	6.0	43	8.0

Table 15

Mean Scores For Cognitive Variables
(Percentage Responding Correctly)

Group of Questions	Sex		Community Type		Size of School			
	Male	Female	Urban	Rural	Size 1	Size 2	Size 3	Size 4
All Cognitive	46	46	47	44	43	46	45	50
General Ecology	53	50	54	50	43	44	46	50
Population	34	36	35	34	34	37	34	34
Resources	43	42	31	30	37	40	41	45
Energy	41	37	41	37	37	37	39	45
Pollution	49	53	52	50	49	52	51	54

Table 16

Analysis of Variance for Knowledge Score

Source	Degree of Freedom	Sum of Squares	F	PR<F
Total	1411			
Region[1]	7	1124.82521	4.82	0.0001 **
Community Type[2]	1	16.33324	0.49	N.S.
Size of School[3]	3	1695.23252	16.94	0.0001 **
Sex	1	0.17615	0.01	N.S
Error	1399			

[1]/ Region refers to the eight state planning regions of Louisiana.

[2]/ Community Type refers to either urban or rural Community the school is located. Rural communities are towns with less than 5,000 people.

[3]/ Size of School refers to four groups of schools subdivided by number of secondary students.

** highly significant

* significant

or 43 percent answering correctly, while small schools ranked lowest with a mean score of 3.9 or 41 percent. There were significant differences at the .001 level among the mean scores of large schools and those of the other school sizes for the general ecology variables. Between regions, the Alexandria-Central Region had the highest mean score with 4.4 or 49 percent followed closely by Houma-Thibodaux with 4.3 or 48 percent. The Monroe Region and the Lake Charles Region had the lowest mean scores with 3.7 or 42 percent. No significant differences were found among regions for the general ecology variables. The students from urban communities scored higher than their counterparts from the rural areas on the general ecology questions. The mean score for urban community schools was 4.2 or 47 percent, while the rural communities had a mean score of 3.9 or 43 percent. There were no significant differences between the urban and rural mean scores for these variables. Table 17 shows the ANOVA table for these variables.

Population Variables. The mean score of the population variables was 2.4 or 35 percent. The mean score among females was 2.5 or 36 percent, while among males 34 percent responded accurately with a mean score of 2.3. Significant difference were determined between the mean scores of the male and female students at the .005 level for the population variables. Medium-small schools had the highest

Table 17

Analysis of Variance for General Ecology Score

Source	Degree of Freedom	Sum of Squares	F	PR<F
Total	1411			
Region[1]	7	42.46600	1.58	N.S.
Community Type[2]	1	0.55208	0.14	N.S.
Size of School[3]	3	60.61704	5.26	0.001 **
Sex	1	22.74068	5.92	0.015 *
Error	1399			

[1]/ Region refers to the eight state planning regions of Louisiana.

[2]/ Community Type refers to either urban or rural Community the school is located. Rural communities are towns with less than 5,000 people.

[3]/ Size of School refers to four groups of schools subdivided by number of secondary students.

** highly significant

* significant

mean scores for these population variables with 2.6 or 37 percent, while large, medium-large, and small schools had a mean score of 2.4 or 34 percent. There were significant differences at the .01 level among mean scores of the large schools and the other sizes of schools for the population variables. The Alexandria-Central Region had the highest mean score with 2.7 or 38 percent, while Lake Charles Region had the lowest mean score with 2.2 or 32 percent. There were no significant differences among the mean scores of the regions. The mean scores for both urban and rural schools were 2.4 or 35 percent. There were no significant differences between the mean scores of the urban and rural community types. Table 18 shows the ANOVA table for the population variables.

Resource Variables. Of the eight knowledge variable associated with natural resources and resource use, 43 percent were answered correctly by all of the students. Significant differences were found among the mean scores of the regions at the .001 level for the resource variables. The Houma-Thibodaux Region schools had the highest mean score of 3.6 or 45 percent. Orleans Region had the lowest mean score of 2.9 or 36 percent. Significant differences were found between the mean scores of the Orleans Region and the other seven regions. Analysis of the data revealed that there were

Table 18

Analysis of Variance for Population Score

Source	Degree of Freedom	Sum of Squares	F	PR<F
Total	1411			
Region[1]	7	13.15266	1.42	N.S.
Community Type[2]	1	0.13460	0.10	N.S.
Size of School[3]	3	14.91054	3.76	0.01 *
Sex	1	11.47142	8.68	0.005 **
Error	1399			

[1]/ Region refers to the eight state planning regions of Louisiana.

[2]/ Community Type refers to either urban or rural Community the school is located. Rural communities are towns with less than 5,000 people.

[3]/ Size of School refers to four groups of schools subdivided by number of secondary students.

** highly significant

* significant

significant differences between the mean scores of students from urban and rural communities at the .05 level in relation to the resource variables. Urban mean score was 3.5 or 44 percent, while the rural mean score was 3.2 or 40 percent. The mean score for the resource and resource use variables among female students was 3.4 or 42 percent, while male students had 3.5 or 44 percent. No significant differences were found between the mean scores of the female and male students for the resource variables. Large schools had the highest percentage correct for the resource variables with 45 percent, while medium-large schools had approximately 41 percent correct. Medium-small schools ranked third between the four groups of schools with 40 percent. Small schools had the lowest percentage of 37 percent for this group of variables. Significant differences were found among the mean scores of large schools, medium-large, medium-small schools, and small schools. Table 19 shows the analysis of variance table for the resource variance by region, sex, community type, and size of school.

Energy Variables. The energy variables had one of the lowest mean scores of the five categories of knowledge variables, with 2.3 or 39 percent. The mean percentage of correct answers among female students was 37 percent, while males answered 41 percent of the variables correctly. There

Table 19

Analysis of Variance for Resource Score

Source	Degree of Freedom	Sum of Squares	F	PR<F
Total	1411			
Region[1]	7	66.44279	3.46	0.001 **
Community Type[2]	1	10.82445	3.95	0.05 *
Size of School[3]	3	137.85990	16.77	0.0001 **
Sex	1	5.07697	1.85	N.S.
Error	1399			

[1]/ Region refers to the eight state planning regions of Louisiana.

[2]/ Community Type refers to either urban or rural Community the school is located. Rural communities are towns with less than 5,000 people.

[3]/ Size of School refers to four groups of schools subdivided by number of secondary students.

** highly significant

* significant

were significant differences between the mean scores of the females and males at the .0002 level for the energy variables. The highest percentage for the energy variables among the four school sizes was from large schools with 45 percent. Medium-large schools ranked second with 39 percent, while medium-small and small schools ranked lowest with 37 percent. There were significant differences at the .0001 level between large schools and the other size schools for the energy variables. No significant differences were found among the mean score of the regions for the energy variables. The Houma-Thibodaux Region had the highest percentage of correct responses with 41 percent, while Alexandria-Central Region had the lowest percentage of correct answers with 37 percent. The mean score for the energy variables among urban students was 2.4 or 41 percent. The rural students performed at a slightly lower mean score with 2.2 or 37 percent. Table 20 shows the analysis of variance table for the energy variables by region, sex, community type, and size of school.

Pollution Variables. The mean score for the pollution variables was 6.6 or 51 percent. Of the five categories of variables, the pollution variables were answered correctly more often than any other group of environmental concepts. Significant differences were found among the means of the regions at the .0001 level for the

Table 20

Analysis of Variance for Energy Score

Source	Degree of Freedom	Sum of Squares	F	PR<F
Totai	1411			
Region[1]	7	13.70226	1.33	N.S.
Community Type[2]	1	0.20221	0.14	N.S.
Size of School[3]	3	35.15510	7.98	0.0001 **
Sex	1	20.58050	14.02	0.0002 **
Error	1399			

[1]/ Region refers to the eight state planning regions of Louisiana.

[2]/ Community Type refers to either urban or rural Community the school is located. Rural communities are towns with less than 5,000 people.

[3]/ Size of School refers to four groups of schools subdivided by number of secondary students.

** highly significant

* significant

pollution variables. The Alexandria-Central Region had the highest mean score of 7.3 or 56 percent. The Orleans Region had the lowest mean score with 6.5 or 50 percent. Significant differences were established among the scores from the Alexandria-Central Region and the other regions. Female students had the highest mean score with 6.8 or 53 percent, while the male students had a mean score of 6.4 or 49 percent. There were significant differences between the mean scores of males and females for this variable at the .0001 level. Large schools had the highest mean score for the pollution variables with 7.0 or 54 percent, followed by medium-small schools with a mean score of 6.8 or 52 percent. Medium-large schools ranked third with a mean score of 6.6 with 51 percent, while small schools had the lowest mean score with 6.3 or 48 percent. Significant differences at the .0001 level were determined for the mean scores among school sizes for the pollution variables. The mean score for the pollution variables among the urban students was 6.8 or 52 percent, while the mean score among rural students was 6.4 or 50 percent. There were no significant differences between the mean scores of students from urban or rural communities for these variables. Table 21 shows the analysis of variance table for the pollution variables.

Table 21

Analysis of Variance for Pollution Score

Source	Degree of Freedom	Sum of Squares	F	PR<F
Total	1411			
Region[1]	7	197.24646	6.05	0.0001 **
Community Type[2]	1	3.22671	0.69	N.S.
Size of School[3]	3	168.52503	12.07	0.0001 **
Sex	1	74.01442	15.90	0.0001 **
Error	1399			

[1]/ Region refers to the eight state planning regions of Louisiana.

[2]/ Community Type refers to either urban or rural Community the school is located. Rural communities are towns with less than 5,000 people.

[3]/ Size of School refers to four groups of schools subdivided by number of secondary students.

** highly significant

* significant

CHAPTER 5

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

The concerns of environmental education have been well established at the Federal level, among scientist, among concerned citizens, and among educators. The enactment of a multitude of programs in various states including state governmental acts which support such programs indicate that concerned citizens in many states are providing the necessary education for themselves in order to be prepared to make the appropriate decisions regarding environmental issues in the future. Studies involving inventories of the knowledge and attitudes of various groups have been conducted in many states and countries for assessing the needs of programs in environmental education. Many programs in Louisiana and other states have been developed without the use of sound research.

The development of a needs-based curriculum plan was designed to gather the data which would be used to form the basis of a curriculum plan for environmental education in Louisiana. The development of a program based on needs assessment is the most efficient manner of providing guidelines and goals.

Procedure

The study utilized an instrument in which 1,412 students in 54 randomly selected schools were surveyed of their opinions and knowledge about the environment.

The instrument used in the study was developed from objectives selected from other state and local plans and studies. One hundred and forty-three objectives were reviewed by faculty members at Louisiana State University. From those objectives 43 were selected and used as the basis to develop cognitive questions. An additional 20 objectives were selected and used in writing affective questions. Some of these affective questions were closely related to counterpart cognitive questions. The instrument was pilot tested at the Louisiana State University Laboratory School and Baton Rouge High School.

The data were collected during a three-month period from March 15, 1980, through June 15, 1980. The data were transfered to computer tape and disk from optically-scored answer sheets. The data were then analyzed using Statistical Analysis System programs.

Analysis of Data

The responses to each question on the instrument were analyzed by frequency and converted to a percentage. Analyses of variance were conducted to determine if

differences existed among regions of the state, between sex of student, between urban and rural communities, and among sizes of school. The analyses used the overall cognitive score, and the score from five categories: 1) general ecology, 2) population, 3) resource, 4) energy, 5) pollution variables and each of the knowledge variables.

Conclusions

From the data gathered, it was determined that the students had little understanding about certain basic environmental concepts. Additional data indicated that the students' attitudes and/or opinions were positive on issues that did not relate directly to the students but were negative on those issues that affected the students directly. It was found that the students believed that that the most serious local problems was waste disposal and the most serious state and national problem was crime. On the international level, the most serious national problem was waste of energy and natural resources. The most serious world problem selected was poverty and hunger.

General Ecological Concepts

The information gathered in this study indicates that less than one-half of the general ecological concepts were understood by the students. Slightly over one-half of the students understood that soils high in organic materials are

most productive. Less that one-half of the students understood that water and carbon dioxide was necessary for green plants to grow. More than one-half of the students did not know the basic metabolites of photosynthesis. A definite need exists within the scope of basic science to re-enforce these concepts. Without understanding such basic activities a student cannot understand the total working of the biosphere.

Even though a majority of students knew that living things are interdependent with one another and their environment, a large percentage remained neutral, disagreed, or had no opinion. Interdependence is an elementary concept that emphasize man's place in the ecosystem. A need exists to illustrate interdependence in every aspect of life whether biological, sociological, or economic terms. A similar question asked whether all living things fit into a food web in which more than one-half agreed. However, almost one-half of the students did not understand this concept. Many admitted that they did not know, while others believed that only some things fit into food webs, some disagreed. The need to develop a program that will help students understand such basic ecological concepts is apparent.

Less than one-third of the students understood that both marine algae and forests supply more oxygen than any other source. About one-third of the students did not know

that oxygen is supplied by either the algae or forests. A need exists for a greater emphasis to be placed on marine science concepts that discuss the role of the ocean in producing and maintaining global oxygen levels. Coupled closely with the source of oxygen is the process of photosynthesis. Only one-third of the students understood that oxygen was a by-product of photosynthesis. One-third of the students selected carbon dioxide while some of the students selected hydrogen. Thus, almost half of the students did not understand the process of photosynthesis and what by-products are produced. Another question asked what role plants had in an ecosystem. A large percentage of the students specified that plants purify the air and provide a cover to hold soil in place but did not know that they act to protect the water supply. One-half of the students did not know that plants had more than one function within an ecosystem. A need exists to teach students about the multi-purposes of plants and the roles they play in an ecosystem.

Population Education

The students surveyed indicated that they knew very little about the most important issue of the decade: increasing population. Scientists agree that the increasing population will have a profound effect on the energy crisis, food crisis, and war. Only one-fifth of the students

realized this. Therefore, population education should be one of the most important goals in an environmental education plan. Population education should involve concepts of population dynamics, reproduction, and sociological issues involving population. Other concepts related to population were answered correctly about one-third of the time. Suggesting that many students do know some basic facts about population, but most do not have an awareness of population dynamics. In one question dealing with man's biological capacity, a great majority of students indicated that man could reproduce without limits or produce all of the food necessary for any size population. These choices indicate that many students think that there is no real population problem. In another question, the students were asked "What determines the population level of an organism?" One-third of the students answered correctly that the available materials and conditions necessary for maintaining life were the factors that determined population levels. The students should understand fully that environmental conditions include space, oxygen, food, and other basic materials. There is an apparent need to stress this concept more in teaching basic biological principles.

Resources and Resource Use

Over two-thirds of the students were unable to correctly identify examples of non-resources, while

three-fourths of the students did not know what the expression "finite resources" means. The results indicated that the students do not have the proper understanding of what types of resources exist and what the limits of these resources might be. Fewer than one-fifth of the students across the state knew that the wetlands were the most biologically and economically productive region in Louisiana, suggesting that more emphasis should be placed on marine science, a close tie to environmental education.

Energy Education

Energy education has been emphasized more during the 1970's than any other area of environmental science. Several federal government agencies and the Louisiana State Department of Education have encourage the development of programs in energy education. It is too early to assess the impact of these programs. Basically, the students do not understand the all-comprehensive role of energy within the ecosystem. Concepts related to energy dynamics and energy flow are poorly understood. Less than one-third of the students realized the impact that energy shortage has on fertilizer production. One-half of the students responded that the least polluting form of energy is nuclear energy. A need exists to establish a more energy-literate citizen, especially where alternative forms of energy are involved. Over one-half of the students did not understand that plants

are the major source of food, clothing, shelter, and energy in all societies today. Knowledge about plants and plant communities needs to be stressed in the curriculum. The role of plants in the ecosystem must be emphasized. When asked about fossil fuels, two-thirds of the students did not know that fossil fuels supply over 60 percent of the energy in the United States. The need exists for students to know to what extent the U.S. is dependent on fossil fuels and how international strife can affect our way of life. Almost all of the students did not realize that political and economic strength of any country is dependent upon the natural resources it has access. The need exists to promote a greater awareness within the scope of resource and energy education.

Pollution Education

Pollution is the most obvious issue with the scope of environmental problems. The results of this study indicate that the students are generally aware of pollution problems. A need does exist to emphasize two major areas of pollution: water and air pollution. The students are not aware of the extent of pollution in the oceans or any aquatic regime. Fewer than one-fourth of the students knew that the ocean is the final dumping place for most pollutants. Air pollution, especially particle pollution is another area that is not well understood. Three-fourths of the students did not know

what impact particle pollution has on the climate. There is a need to clarify certain facts about pollution and how pollution can be reduced or prevented.

Attitudes

In response to the general affective questions, a large number of students demonstrated positive attitudes about the environment on issues that had a limited effect on the individual: but with issues that had a direct effect on lifestyle, freedom, or economic choices, the students seemed less favorable. Attitudinal needs are difficult to ascertain: however, from these data there is an indication that students do not relate directly to environmental problems. Thus a need exists for students to develop attitudes that would encourage them to take a more active role in affecting environmental problem.

Recommendations

The study has indicated that certain needs are prevalent among high school students in Louisiana. It might be assumed that the cognitive and affective level that these students have demonstrated reflects what the average population of Louisiana knows and believes about the environment. A corollary may be further stated, that some kind of program emphasizing environmental education should be established to develop a more literate citizery who would

be capable of making the appropriate decisions in the future about those issues that could have lasting affects on the population, resources, and culture of Louisiana. The program would be established, by developing an Environmental Education Plan for Louisiana.

The study did not examine any other grades for possible differences or needs. Further study may consider an assessment of several grades and/or parents. In addition, a survey of the teachers' knowledge and attitudes about the environment may also yield additional information. A survey could be conducted on the non-student population and/or various age groups, to determine the level of knowledge and attitudes about the environment. College and university students may be assessed, especially students with interests in environmental sciences.

Two final recommendations for further study should be conducted if the state program in environmental education is to be implemented. First, a survey of all the possible programs in every school throughout the state that deal specifically with environmental education should. be conducted. Such a survey would locate interested teachers and schools for future contacts and would allow some evaluation of what is presently being offered. The final recommendation includes a follow-up survey involving testing students after a pilot program in environmental education has been initiated. This would help establish whether the programs had accomplished the goals stated in a plan.

CHAPTER 6

A STATE PLAN IN ENVIRONMENTAL EDUCATION FOR LOUISIANA

Introduction

A plan in environmental education for Louisiana would precipitate the development of a multidisciplinary program about the environment and would recommend how such a program might be implemented. Such an environmental education plan would focus on encouraging and motivating the development of a society of environmentally literate citizens who would have an environmental ethic consciousness and will participate in future decision-making processes. A plan in environmental education would provide the basis for schools, conservation organizations, and private individuals to work together for a common goal. A fully comprehensive environmental education plan would identify the economic, political, human, and other resources that might aid in implementing such a program.

Statement of Need

Environmental education should be considered as a comprehensive life-long educational experience concerned with shaping an individual's values. Only by integrating social, biological, and physical concepts under one curriculum which would enhance and interact with many

diverse fields, could such a comprehensive learning experience occur. By improving one's overall awareness of the environment, attitudinal or value changes may occur which could effect behavioral changes, instituting real social change. Such a social change is needed to insure that the quality of life on earth is improved. The behavior of individuals will affect the world of the future, likewise, the choices made at the present will affect the future. The knowledge and attitudes that are acquired will affect those future behaviors and thus may allow alternatives to the future. To improve the knowledge level of an individual and to alter his behavior some change must occur. This change can be implemented by modifying the curriculum. At least three general areas exist in all curriculum plans; these are: 1) who should be taught, 2) what should be taught, and 3) how should they be taught.

Who Should Be Taught?

The most effective age to create an awareness and to effect a value change is in the pre-school, elementary, and secondary years of life. By providing the experiences necessary to encourage and motivate students to become aware of their environment, educational programs at these age levels should be most effective in changing and shaping attitudes. Leadership and support at the state and local level is necessary for such a program to be viable. A

comprehensive state plan would be the cohesive factor for a curriculum that would bring together all of the resources and knowledge necessary to create an educational program for all citizens.

What Should Be Taught?

To create environmentally literate citizens, an inclusion of five basic components into many subject areas at the secondary level must be envisioned. These components would include: general ecological concepts; population education; resource management and conservation education; energy education, and pollution education.

Definition

When dealing with any broad educational area, it is important to have a definitive statement to serve as a focal point. There are basically two definitions for environmental education. From one, the U.S. Office of Education (1970) states:

> Environmental education is the education process dealing with man's relationship with his natural and man-made surroundings, and includes the relation of population, pollution, resource allocation and depletion, conservation, transportation, technology, economic impact, and urban and rural planning to the total human environment. (U.S. Congress 1970)

A second definition developed from the definition included in the Belgrade Charter (1970) is:

> Environmental education is defined as the process of developing knowledge, understanding, attitudes, and responsibility with regard to man's relationship to his sociocultural and biophysical surroundings.

These definitions should not preclude the formulation of even broader views, environmental education is an evolutionary process radiating into new areas.

Main Goals

The main goal of environmental education should be to create an environmentally literate citizenry. Environmental literacy would be achieved, by providing citizens with the basic background to recognize environmental problems when they occur, by providing programs that would allow the citizens of a community to understand the basic concepts of the interrelationships of man and his (bio-physical) environment. Another goal would be to encourage long-range planning and emphasize the use of the scientific approach when examining the many facets of an environmental problem. This could be done by providing an educational program that

relates knowledge about the bio-physical environment to actual problems in the environment. A third goal would be to encourage citizens to participate in the decision-making processes regarding environmental issues.

Other Goals

Several other goals that an environmental education plan would include are:

1) Encouraging the citizenry to develop a sense of "stewardship" for the land.
2) Recognizing the need to curtail individual privileges and rights to certain resource for long-range public good.
3) Recognizing the need for population awareness and family planning which would insure the future goals of mankind.
4) Recognizing ecological interrelationships of all living things and extending the concepts of humanness to all life.
5) Understanding the need for diversity in the environment.
6) Realizing that continual examination of the value system within man's society is necessary to incorporate new constructive ideas and facts about the environment and to discard those obsolete or destructive ideas.

How Can These Goals Be Achieved?

To achieve these stated goals a program of environmental education should be instituted and should consist of the following points:

1) A definition for the terms "environment" and "environmental education" should be established. These terms have been defined by previous individuals and groups (Roth 1976, Belgrade Charter 1978). The term "environment" should include the total environment meaning all of the surroundings which include, biological, physical, chemical, and social parameters.

2) An advisory committee from all government agencies and organizations with an interest in education should be developed. The committee would be subdivided into the five basic subject areas: 1) General Ecology--Made up of biologists, scientists, and science educators from higher education, the public school, community, and industry; 2) Population-- Composed of social scientists, medical professional people, and psychologists from various academic and professional areas; 3) Resources--Made up of wildlife specialists, foresters, geologists, industrial representatives, and other professionals from the business community; 4) Energy--Including

individuals from nuclear science, geologists, chemists, and utility engineers; 5) Pollution--Containing federal and state regulatory personnel, representatives from industry, and medical and safety personnel. The purpose of the committee would be to examine the possibility of initiating a statewide envionmental education program and drafting a bill which would create special funding for the plan.

3) An inventory of resources should be initiated and a statewide network of interested persons willing to work in the environmental education program within their fields should be developed. Through this network a state survey would be conducted of the present programs at all level, public and private, in environmental education. Concurrently, it would be important to develop a newsletter informing teachers administrators, and concerned citizens of current environmental problems and issues.

4) Another step would be the development of Louisiana Office of Environmental Education within the State Department of Education. The responsibility of the Office of Environmental Education would would be to aid in the dissemination of information and educational materials to the public, particulary

elementary and secondary students and teachers in public and private schools and the coordination of environmental education activities. The Office of Environmental Education would work jointly with the Louisiana Department of Education, the Louisiana Department of Culture, Recreation and Tourism, Louisiana Cooperative Extension Service, Office of State Planning, Louisiana Department of Natural Resources, and Louisiana Department of Wildlife and Fisheries to promote programs dealing with environmental awareness and to encourage public assistance and cooporation in environmental problems. A primary purpose of the Office of Environmental Education would be to map out a series of environmental programs to be instituted into public and private schools for "educating the educator."

General Curriculum Objectives

The plan for environmental education includes general objectives. Since the initial target population for developing an environmentally literate citizenry are students in grades K-12, the curriculum plan would be concerned with this age group. Learning activities are best described by describing a sequence of observable and measurable behavorial changes that indicate learning has

taken place. General objectives can aid in assessing the learning outcome of the students. Within this plan, 43 cognitive objectives are established for inclusion into a curriculum plan as a minimum. Each general objective may be grouped according to its category. There are five categories of objectives: 1) General Ecological Concepts; 2) Population Concepts; 3) Resource and Resource Use Concepts; 4) Energy and Energy Use Concepts; 5) Pollution Concepts. The general objectives in the environmental education plan for Louisiana represent ideas that should be included in the development of each local program in environmental education.

Each general objective may be incorporated into its specific category for the purpose of discussing alternatives on how these can be fulfilled. A coding for each curriculum area is listed beside each of the objectives. The are: (B)-Biology; (Bus)-Business; (C)-Chemistry; (CA)-Creative Arts; (E)-Earth Science; (G)-Geography; (H)-Health; (H.Ec.)-Home Economics; (IA)-Industrial Arts; (LA)-Language Arts; (M)-Mathematics; (Phy)-Physics; (Psy)-Psychology; (G.Sci.) General Science; (SS)-Social Studies; (VA)-Vocational Agriculture. There are many other disciplines in which environmental concepts can be coupled , such as reading, physical education, free enterprise, civics, economics, drug education, Louisiana studies, and driver education.

General Ecology

Needs in developing ideas about the environment can be met by formulating concepts based on sound facts and evidence. General ecological principles should be emphasized in teaching general biology, life science, earth science, chemistry, marine science, and certain aspects of geography, history, and sociology. Very few teachers have been exposed to basic ecological principles and facts; even science teachers are not required to have a course in general ecology. All teachers who are involved in the instruction of any of the previously stated science subject areas should have a broad background in general ecology. Teachers should be exposed to all of the traditional areas of ecology such as community dynamics, habitats, energy dynamics, community structure, speciation, population dynamics, physical, and chemical factors affecting the environment. Table 22 shows how the general ecological principles might be integrated into several subject areas. There are nine major objectives related to general ecology. These are all based on one universal objective: The students will understand certain biological concepts related to general ecology.

Population

Needs in developing an awareness for population problems can be met by providing facts and general

Table 22

General Ecology Objectives and Curriculum Areas

Objective	Possible Curriculum Areas
1) Knows that green plants capture carbon dioxide and water from the environment and energy from the sun for growth.	B, C, E, G, G.Sci, VA
2) Comprehends that all living things are interdependent with one another and their environment.	B, G.Sci, SS Psy, VA
3) Knows that most of the oxygen in the atmosphere comes from marine algae and forests around the world.	B, C, E, G, G.Sci, SS, VA
4) Understands that oxygen is a by-product of photosynthesis.	B, C, E, G.Sci, VA
5) Comprehends that all living things fit into a food web.	B, C, E, G, CA LA, SS, VA
6) Understands that plants including trees purify the air, provide a cover to hold the soil in place, protect the water supply, shelter wildlife, supply many materials for man's needs, and add beauty to the landscape.	B, E, G, G.Sci, H, SS, VA
7) Understands that a change in the world's average temperature of several degrees would affect the world's climate.	B, C, E, G, H, IA, M, Phy., G.Sci, VA
8) Understands that an organism may become extinct if the rate of change in an environment exceeds the rate of organism adaptations.	B, E, G, H, G.Sci
9) Recognizes that biological systems are described as dynamic because the materials and energy involved are parts of continuous cycles.	B, C, E, G, H, IA, M, Phy., G.Sci, SS, VA

information about population dynamics, especially in areas relating to human ecology. Over-population is cited most as the greatest world problem. Relationships between prosperity and reduced population have been well established. Courses in family living is one area where family planning and population education have been taught, however, biological principles concerning population and human reproduction should also be taught. Parents and teachers must also be informed about facts associated with reproduction before students are taught. To be informed teachers, must be encouraged to take courses that will prepare them to provide learning opportunities for students in population education. Five subject areas are appropriate vehicles for teaching population education: 1) Biology and/or life science. Since population education relates closely to human ecology; general biology is one of the most appropriate subjects in which such principles could be presented. Comparisons between natural systems offer models for a better understanding of how population dynamics and population ecology relate to human ecology. 2) Family living and/or home economics. Family living has been a traditional field to teach certain basic principles related to human ecology, however, in the past, these subject areas have been limited to teaching family planning and not population education. 3) Physical education and/or health. Physical education program are one of the best areas to

teach population ecology, but too often teachers with the job of teaching such information have a limited biological background and are reluctant to cover certain areas of human ecology--specifically human reproduction. 4) Social sciences and/or history and geography. These subject areas offer opportunities to relate population ecology to the events that have shaped history and are in the process of doing so at the present. The recognition of the historical significance of the effects of human ecology on ancient civilizations allows students to understand the impact demographic changes have made on the earth. Comparisons between geographical regions can be use to show how human ecology affects the environment and is in turn affected by the environment. Too often social science teachers are not trained in the basic biological principles needed to relate the historical or geographical facts to future population issues associated with ecology. 5) Sociology and special humanistic subject areas. Problems in society often originate from general human ecological problems. Overcrowding, disease, mental illness, and family problems are types of social problems in which population education may be introduced. Teachers working in this subject area are often not trained in many of the basic biological principles that are asociated with population ecology. Table 23 shows how population education could be incorporated into these five subject areas. Seven major

TABLE 23
Population Objectives and Curriculum Areas

	Objective	Possible Curriculum Areas
1)	Knows that increasing world population is one of our greatest crisis.	B, C, CA, E, G, G.Sci. H. H.Ec. M, SS, VA
2)	Knows that man has the biological capability of reproducing faster than he can grow food.	B, H, H.Ec., G. Sci. M VA
3)	Understands factors that affect population growth.	B, C, E, G, G.Sci, H, M, Psy, SS
4)	Understands that increasing populations deplete resources faster.	B, C, E, G, G. Sci, M, SS, VA
5)	Recognizes that food is a major limiting factor for all populations.	B, C, E, G, H.Ec, M, SS VA
6)	Recognizes earth's capacity to maintain life is limited for all species including man.	B, E, G, G.Sci, VA
7)	Understands that the available materials and conditions necessary for mainatining life determine the population level of an organism.	B, C, E, G, H, IA, M, Phy, G.Sci, VA

objectives relate to population education which are based on one central objective: The students will understand certain concepts related to population education.

Resources

Needs in understanding resources and resource use can best be met by emphasizing facts and information about resources unique to a region in courses such as geography and history, including Louisiana studies. Outside specialists from the community should be encouraged to participate in local schools by giving special presentations to classes. Resource use is a vital economic concern within our society. Emphasis concerning the effects of resource use and depletion of resources can be related to historical, current social, and future issues. Teachers should have easy access to materials on resources, especially those found in Louisiana. Professional organizations and industry could be enlisted to help provide materials and information about the resources they use. The value of certain resources can be appreciated more when economic factors are realized. Eight major objectives relate to resource and resource-use education. The eight objectives relate to a more general objective: The students will understand certain concepts related to resources and resource-use education. Table 24 shows a listing of objectives and with which courses they may be used.

Table 24

Resource Objectives and Curriculum Areas

	Objective	Possible Curriculum Areas
1)	Identifies non-renewable and renewable resources.	B, C, E, G, G.Sci, VA
2)	Knows that soils with high levels of organic content are most productive.	B, G.Sci, H. Ec, SS, VA
3)	Understands that recycling materials is the best method of conserving resources.	B, C, E, G, G.Sci, SS,
4)	Understands that wildlife populations are economically, aesthetically, and biologically important.	B, C, CA, E, G.Sci, H, SS, VA
5)	Recognizes that wetlands are the most economically and biologically productive region of Louisiana.	B, C, CA, E, G, SS, VA
6)	Comprehends that a finite supply of a resource refers to limited non-renewable resources.	B, C. E. G. IA, SS, VA
7)	Understands that the regulated harvest of wildlife by recreational hunting and fishing is man's way of removing surpluses which would otherwise be removed naturally.	B, G, Psy, SS, VA
8)	Knows that soil erosion is taking place at a greater rate than soil is being replaced.	B, CA, E, G, G.Sci, M, SS, Va

Energy

Needs in understanding energy and energy use can be fulfilled by incorporating a broad program in energy education. Materials developed by the Louisiana State Department of Education and the Louisiana Department of Natural Resources have been designed as a guide for teachers in grades K-12. Developing workshops for teachers to show them how to use the guide could be an excellent means of providing input in environmental concepts to the teacher. Several school subject areas could utilize this energy information, although, science teachers are usually singled out for dissemination. Chemistry and physics teachers could use special energy materials to enhance their programs. A greater emphasis could be made in biology curricula and life science programs which rarely include energy concepts. Energy dynamics are usually taught by using food chains, food webs, and other well known bio-energy relationships. However, thermodynamic laws apply to biological systems as well as to physical systems, and associated with energy and energy use should include energy transfer, productivity, and biomass. One reason this information is lacking is that most biology teachers are exposed to traditional ecological information but often are not taught about energetics. Other courses offer excellent opportunities to teach concepts about energy. Economics, usually taught at the twelfth grade level, should include objectives that pertain

to growth and limits to growth and the relationship between energy and the gross national product. Students should be aware of both economic ideas, especially where national economic policies merge with resource and energy availablilty. History courses, especially those focusing on the twentieth century, should contain objectives that relate to the underlying reasons for national expansionism and how they relate to energy and resource needs. Table 25 shows how this area of environmental education can be included in the present-day curriculum. Six major objectives are concerned with energy and energy-use education. The six objectives compose a more broad universal objective: The students will understand certain concepts related to energy education.

Pollution

Needs associated with an awareness pollution problems and how they can be prevented can be met by improving problem-solving skills since pollution is a problem-oriented area. Pollution exists in both natural systems as well as man-made systems. Students should be exposed to problem identification and problem issues in order to promote an awareness of current issues and how they can be solved. Concepts associated with cost/benefit relationships should also be included. Value judgments must be integrated into problem-solving and role-playing activities in order for

Table 25

Energy Objectives and Curriculum Areas

	Objective	Possible Curriculum Areas
1)	Recognizes that the burning of fossil fuels can affect the atmosphere by changing the composition of the atmosphere.	B, C, E, G, G.Sci, H, H.Ec, IA, M, SS, VA
2)	Understands that the food costs are affected by the costs of fossil fuels.	B, G.Sci, H, H.Ec, IA, M, SS, VA
3)	Recognizes that the sun, wind, tides, and atom are sources of energy.	B, C, CA, E, G, G.Sci, CA, SS, P
4)	Knows that natural gas is the least polluting form of energy.	B, C, E, G.Sci, H, H.Ec, IA
5)	Knows that over 80 percent of the energy used in the U.S. is supplied by fossil fuel.	B, C, E, G, H, IA, M, SS, VA
6)	Understands that the major source of food, clothing, shelter, and energy in all societies is green plants.	B, G, H.Ec, IA SS, VA

students to develop positive attitudes about what should be done to solve pollution problems. The inclusion of pollution education into a curriculum plan in environmental education can be done in several ways.

1) Physical and chemical relationships within the environment can be emphasized in science courses such as chemistry, earth science, marine science, and physical science. This emphasis will utilize concepts associated with the balance in nature.
2) Biological investigation into polluted areas and non-polluted areas would offer a comparison for the student. This type of learning activitiy would involve the student.
3) Students can be exposed to local and national pollution issues through use of audio-visual aids.
4) Debates within social science courses regarding political-economic policies that have a negative impact on the environment could be conducted.
5) Role-playing and scenario development can be conducted to develop social interaction and to develop group action.
6) Students groups could participate in an activity that involves a pollution issue. This could be done by cleaning up an area or participating in an anti-pollution campaign.

Table 26 shows an approach to developing a greater awareness of pollution problems. Thirteen major objectives deal with pollution problems. A universal objective for pollution education may be stated as: The students will understand certain concepts related to pollution problems.

Facilities and Resources

An environmental education program would be an all-inclusive learning experience, that pulls together many subject-related fields. This could be done by utilizing presently existing resources such as museums and state parks. The development of science centers could be anticipated to concentrate resources and personnel for the presentation of environmental programs (Kimche 1978).

Museums

The use of presently existing museums could be enhanced by utilizing them as multipurpose educational learning centers. Programs could be developed to train classroom teachers in effective use of museums. Furthermore, additional programs could be established for visiting classes.

Table 26

Pollution Objectives and Curriculum Areas

	Objective	Possible Curriculum Areas
1)	Knows that the ocean is the final dumping place for most pollutants.	B, C, E, G, G.Sci, H, M
2)	Understands that raw sewage, chemicals, and agricultural run-off contribute to the pollution of lakes, rivers, and sea shores.	B, E, G, IA SS, VA
3)	Understands that particle pollution in the atmosphere has a tendency to decrease the earth's atmosphere and thus change the climate.	B, C, E, G, G.Sci, Phy, VA
4)	Recognizes that air pollution can affect the environment by causing the deterior-ation of metal, brick, and cement, and also by destroying animal and plant life.	B, C, E, G.Sci, H. IA, VA
5)	Knows that some agricultural activities deteriorate the quality of water in some areas.	B, C, E, G, SS, VA
6)	Recognizes that too much noise can be physically, mentally, and emotionally harmful.	B, E, G, G.Sci, IA, Psy, SS
7)	Understands that pesticides that must used, must be carefully controlled since they are detrimental to many unintended species when used improperly.	B, C, E, G, G.Sci, IA, M, Phy, VA
8)	Recognizes that air pollution may come from natural or man-made sources.	B, C, E, G, H, G.Sci,
9)	Recognizes that effluent from a sewage treatment facility could have damaging effects on plant and animal life and on public health.	B, C, E, G, G.Sci, H, IA, VA
10)	Understands that both pollution and human presures affect the amount and quality of fresh water.	B, C, G, G.Sci, H IA, Phy SS, VA
11)	Recognizes that growing industrial countries have the greatest noise pollution problem.	B, C, G, G.Sci, H, IA SS, VA

Table 26 continued

Objective	Possible Curriculum Areas
12) Understands that improper or overuse of recretional areas causes land management problems and costs the taxpayer money.	B, E, G, H, G.Sci
13) Understands that recreational activities can be limited by pollution.	B, C, E, G, H, IA, M, Phy, G.Sci, SS, VA

State Parks, Commemorative, and Preservation Areas

Under the Louisiana State Parks Plan (1975), four major objectives have been established. Of these, two are related directly to education:

1) Portraying and interpreting plant and animal life, geology, and all other natural features and processes included in the various state parks.

2) Preserving, protecting, and portraying historic and scientific sites of statewide importance.

Schools could utilize state parks in their area more fully, by using them as outdoor classrooms. Park naturalists, historians, and other specialized individuals could play a vital role in educating teachers and students about the

natural and cultural values of each park. A joint effort between local school boards, the State Department of Education and local state parks could be initiated to aid in the development of environmental education programs in state parks that could be used by schools in the surrounding areas around the park. This aid could be in the form of adding personnel trained in environmental education and creating special interpretive facilities. Special grants could be awarded for the development of environmental education materials and programs designed around the the use of state parks that could be integrated into the schools.

City Parks and Parish Parks

City or parish parks that are used for recreation have a dual role and, thus, can be developed into nature study areas or nature parks. A multi-use approach allowing recreational use to continue but with the addition of an educational dimension would encourage the use of the parks for purposes other than recreation. A primary goal of every city and parish recreation system should be to use each facility that is available at a maximum, especially where areas of education are concerned.

National Forest and Other Federally Owned Lands

National forests and other federal lands offer the same potential as state lands. The utilization of such lands

where possible should be encouraged. Joint cooperation between local school boards and agencies governing federal lands should be developed. These resources offer ideal study areas for classrooms. The initiation of the Youth Conservation Corps programs have done much to promote environmental education. A joint venture between the U.S. Forest Service and the schools could help promote more career opportunities in forestry, biology, and environmental sciences.

School Sites

The utilization of school site resources should be initiated by teachers in Louisiana schools. Principals and superintendents should encourage teachers to develop study sites for teaching concepts related to environmental education. Guidelines for establishing and maintaining such sites should be published by the Louisiana State Department of Education. Special funding should be available for local school systems to develop and promote school sites.

Other Resources

The utilization of community and state resources and personnel should be initiated and coordinated by each local parish school system. Personnel from state agencies dealing with environmental matters should be available to schools. The Louisiana State Department of Education should assist

each parish system by providing information and suggestions on how to develop outside resources. Other resources might include representatives from utility companies, businessmen, and personnel from federal agencies that must deal directly with environmental issues.

Summary

The use of additional resources and facilities for environmental education is essential in developing an adequate program. Moreover, by utilizing a multi-array of resources, a diverse program would emerge. Such a multidisciplinary approach would link the humanities and social sciences closer to science. Natural history learning centers, science centers, nature parks, botanical gardens, and zoos could be instrumental in integrating the art, history, and culture of an area into an environmental learning experience.

Future of Environmental Education

Teacher specialization in environmental education will be required as more materials are added to the curriculum. Specialized training will be needed for supervisors, coordinators, and instructional personnel. This training could include coursework in special resource areas, earth sciences, biological sciences, and economics. This could be

best accomplished by providing a series of summer courses through state universities for elementary and secondary teachers who would be involved in teaching or incorporating environmental education into a curriculum. Education about the environment, in the environment, and for the environment would prevail at every level. Summer workshops for students, teachers, the elderly, and the mentally and physically handicapped could be conducted at state parks, national forest facilities, or museums. In this manner, a comprehensive and dynamic environmental education could be offered to all citizens of Louisiana. Other forms of training could be workshops, seminars, and conferences at universities and colleges. Even though in many states there has been a surplus of specially trained personnel in environmental education, Louisiana does not have such a surplus.

The final development of a curriculum in environmental education would evolve into a permanent program within each parish school system. One possible way to insure a permanent program would be to develop environmental education centers around the state for the purpose of disseminating information and providing expertise. It is hoped that eventually environmental education centers will become a part of every school system, much as libraries, media centers, and cooperative extension programs have done, but by offering a multidisciplinary program in the schools

and community. These centers will offer the proper programs, materials, and expertise for the citizens in every parish.

Conclusion

The current environmental crises are not temporary but are emerging to engulf the entire world. Permanent solutions to these crises can only be developed in a global context. The Report to the Club of Rome (Mesarbuic and Pestel 1976) lists four global ethics. One of these includes the development of a global consciousness through which every individual realizes his role in the world community. A second involves a new ethic for the use of natural resources which will be compatible with the oncoming age of scacity. Development of attitudes of harmony with nature and a greater awareness of our responsibility to future generations is a third ethic. Finally, a conclusive, comprehensive land ethic concept must be realized and integrated into education. All of these "ethic" ideas are lucid and cogent, but they must reach into the minds of individuals. The local level is the place to begin: We must "think globally, and act locally" (Dubos 1978). By providing the mode to teach individuals through environmental education, the future of both mankind and his environment can be secured.

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APPENDIX A

Part I

Directions : Read all of the questions carefully. Select the one response which you believe provides the best answer. Mark your choice in the appropriate box on the ANSWER SHEET provided.

1. What is the world's greatest crisis?

a) food supply
b) energy shortage
c) increasing population
d) threat of war

2. Which one of the following statements is most correct?

Man has the biological capability of reproducing:
a) beyond the availability of food resources.
b) all the food necessary for any size population .
c) without limits.
d) all of the above.

3. The world's population is increasing even though there has been a decline in the birth rate. Why you think it is increasing?

a) more available food
b) less war
c) better health care
d) people live longer
e) all of the above
f) a & c

4. As populations increase, resources will be

a) depleted faster.
b) increased faster.
c) at an equilibrium.
d) more abundant.

5. Where is the final dumping place for most pollutants?

a) atmosphere
b) ocean
c) soil
d) rivers

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6. Which of following wastes contribute to the pollution of lakes, rivers, and sea shores?

a) raw sewage
b) chemicals
c) agricultural run-off
d) all of the above

7. Which of the following are non-renewable resources?

a) wood and paper products
b) iron and copper
c) minerals
d) animals
e) a & b
f) b & c

8. Which one of the following soil types are the most productive?

a) soils with high levels of sand
b) soils with high levels of organic content
c) soils with high pH levels
d) soils with low pH levels

9. What factors affect growth in green plants?

a) water and carbon dioxide in the presence of sunlight
b) water and oxygen in the presence of sunlight
c) water and soil in the presence of sunlight
d) water and energy

10. Living things are interdependent with one another and their environment.

a) agree b) neutral c) disagree d) no opinion

11. Particle pollution (increase in soot, dust, ect.) in the atmosphere has a tendency to

a) increase the earth's temperature and thus change the climate.
b) decrease the earth's temperature and thus change the climate.
c) stabilize the earth's temperature.
d) none of the above.

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12. Where does most of the oxygen in the atmosphere come from?

a) algae that live in the oceans
b) forests around the world
c) both a & b
d) none of the above

13. Which one of the following methods would aid more in reducing a shortage of wood and wood products?

a) plant more trees
b) cut more trees
c) recycle more paper products
d) purchase more wood and paper from abroad

14. How are wildlife populations important?

a) They are economically important.
b) They are aesthetically important.
c) They are biologically important.
d) All of the above
e) They are not important to man.

15. Where is the most economically and biologically productive region of Louisiana?

a) forested areas
b) agricultural lands
c) wetlands
d) cities

16. How can the burning of fossil fuels affect the environment?

a) It can change the composition of the atmosphere.
b) It can increase the oxygen level of the world
c) It can reduce the average world temperature
d) None of the above

17. How does air pollution affect the environment?

a) It causes the deterioration of metal, brick, and cement.
b) It has a damanging effect on animals.
c) It has a damanging effect on plants.
d) All of the above

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18. If the cost of energy goes up, the cost of food production usually goes up. Why? Select the best answer.

    a) Because modern fertilizers require energy for their production.
    b) Because farm labor cost more.
    c) Because most of our food comes from overseas.
    d) Because there is less energy available to farmers.

19. Which of the following are sources of energy?

    a) sun and wind
    b) sun, wind, and tides
    c) sun, wind, tides, and the atom
    d) wind and tides

20. Which one of the following produces the least amount of pollution?

    a) use of nuclear energy
    b) burning of natural gas
    c) burning of coal
    d) burning of gasoline

21. What is the approximate percentage cf energy supplied by fossil fuels in the U. S.?

    a) 60%
    b) 40%
    c) 80%
    d) 100%

22. What is the major source of food, clothing, shelter, and energy in all societies?

    a) fossil fuels
    b) oil and gas
    c) green plants
    d) sand

23. What is a by-product of photosynthesis?

    a) carbon dioxide
    b) oxygen
    c) water
    d) hydrogen

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24. All living things fit into a food web.

a) true b) false c) don't know
d) only some things fit into a food web

25. What role do plants (including trees) play in an ecosystem?

They:
a) purify the air
b) provide a cover to hold soil in place
c) protect the water supply
d) shelter wildlife
e) all of the above
f) only a & b

26. Would a change in the world's average temperature of several degrees affect the world's climate?

a) No, it would not have any real effect on the world's climate.
b) Yes, it would greatly affect the world's climate.
c) Yes, but it would affect only those regions where it is usually cold.
d) Yes, but it would affect only those regions where it is usually hot.

27. How do some agricultural activities affect aquatic ecosystems?

a) They improve streams and rivers.
b) They deteriorate the quality of water in some areas.
c) They have no effect on rivers and streams.
d) They often improve lakes.

28. An organism may become extinct if the rate of change in an environment

a) exceeds the population level.
b) exceeds the rate of organism adaptations.
c) improves.
d) is reduced.

29. Since the supply of matter is limited, the continuation of life depends upon

a) the water cycle.
b) a cyclic flow of materials between organisms and their environments.
c) more materials from the solar system.
d) the continued use of raw materials.

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30. A "finite" supply of resource refers to:

a) unlimited supplies of fossil fuels.
b) limited non-renewable resources.
c) unlimited resources.
d) limited renewable resources.

31. Too much noise can be

a) physically harmful.
b) mentally harmful.
c) emotionally harmful.
d) all of the above
e) none of the above

32. Which statement about the use of pesticides is most correct?

a) Pesticides have been good because they can kill any kind of insects.
b) Pesticides have been bad because they can kill too many kinds of insects.
c) Pesticides must be carefully controlled since they are detrimental to many unintended species when used improperly.
d) Pesticides should be prohibited.

33. What function does the regulated harvest of wildlife by recreational hunting and fishing have in an ecosystem?

a) a natural way of removing surplus animals.
b) man's way of removing supluses which would otherwise be removed naturally.
c) no longer an acceptable means of regulating populations of animals.
d) none of the above

34. What is a major limiting factor of most populations?

a) fossil fuels
b) shelter
c) food
d) space

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35. Which of the following is a source of air pollution?

a) volcano eruption
b) automobile emissions
c) natural gas leak
d) smoke from a cigarette
e) all of the above
f) none of the above

36. At what level is soil being lost annually due to erosion?

a) Soil is being lost at a level greater than it is being replaced.
b) Soil is being replaced at about the rate it is being lost.
c) Soil is being replaced at a level greater than is being lost.
d) Soil is no longer being lost at any great level.

37. Earth's capacity is limited for

a) all species except man.
b) certain animals such as mammals and reptiles.
c) all species including man.
d) all plants.

38. What determines the population level of an organism?

a) The available food and space necessary for maintaining life.
b) The available materials and conditions necessary for maintaining life.
c) The reproductive rates of a population.
d) The population level for a given species.

39. How would the seepage from a sewage treatment facility affect the environment?

a) It could have damaging affects on plant life.
b) It could have damaging affects on animal life.
c) It could have damaging affects on public health.
d) All of the above
e) It has no real affect on the surroundings.

40. What might affect the amount and quality of fresh water?

a) pollution
b) human pressures
c) both a & b
d) Neither a or b

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41. In what area is noise pollution an increasing problem? *answer*.

a) In rural areas.
b) In underdeveloped nations.
c) In a growing industrial nation.
d) In the suburbs.

42. What does the improper use and overuse of recreational areas cause?

a) It can cause land management problems.
b) It can cost the taxpayer money.
c) It can reduce interest in recreational areas.
d) All of the above.

43. What can limit the use of recreational facilities and/or activities?

a) reduced interests
b) pollution
c) space
d) crime

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Part 2

Directions: For items 45 - 65 there are no "right" or "wrong" answers. Simply select the response which best expresses your opinion about each statement and mark on the answer sheet.

44. Planning which will limit the size of families is important if overpopulation is to be avoided.

a) agree b) neutral c) disagree d) no opinion

45. The demand for energy is critical enough to justify relaxing some of the environmental restrictions which hinder energy production.

a) agree b) neutral c) disagree d) no opinion

46. A national land-use plan should be prepared and enforced to prevent housing and industry from using much of the best agricultural land in the U. S.

a) agree b) neutral c) disagree d) no opinion

47. In order to keep oil and gas from being used up too fast, the United Nations or some other international organization should attempt to ration them.

a) agree b) neutral c) disagree d) no opinion

48. Industry should be encouraged to use recycled materials even if it costs less to make the same product from raw materials.

a) agree b) neutral c) disagree d) no opinion

49. The most important thing to consider about bringing new industry into your area is the number of new jobs it will create.

a) agree b) neutral c) disagree d) no opinion

50. Most of the concern about environmental problems has been over-exaggerated.

a) agree b) neutral c) disagree d) no opinion

51. Only strong government controls will reduce pollution problems.

a) agree b) neutral c) disagree d) no opinion

52. An individual has too much power in determining the way he lives.

a) agree b) neutral c) disagree d) no opinion

53. Controls should be placed on industry which will protect the environment even if it means things will cost more.

a) agree b) neutral c) disagree d) no opinion

54. It is more important to preserve the freedom of the individual than to enforce laws to protect the quality of life in the future.

a) agree b) neutral c) disagree d) no opinion

55. Continued political and economic strength of a country is, in part, dependent upon the natural resources to which it has access.

a) agree b) neutral c) disagree d) no opinion

56. The management of natural resources to meet the needs of successive generations demands long range planning.

a) agree b) neutral c) disagree d) no opinion

57. People who live in the suburbs generally are more concerned about environmental problems than people who live in rural areas.

a) agree b) neutral c) disagree d) no opinion

58. Choices between human needs and human wants must be considered if we are to to improve our quality of life.

a) agree b) neutral c) disagree d) no opinion

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59. Which one of the following problems do you think is the most serious in your community?

a) land use
b) traffic problems
c) air and water pollution
d) waste disposal
e) crime

60. Which one of the following problems do you think is the most serious in Louisiana?

a) land use
b) air and water pollution
c) waste disposal
d) public health
e) crime

61. Which one of the following problems do you think is the most serious in the U.S.?

a) land use
b) air and water pollution
c) waste disposal
d) public health
e) crime

62. Which one of the following problems do you think is the most serious in the U.S.?

a) threat of war
b) poverty
c) lack of energy
d) waste of energy and natural resources
e) education

63. Which one of the following problems do you think is the most serious in the world?

a) poverty and hunger
b) population
c) energy
d) war
e) pollution

64. Which one of the following best describes the way in which you have been informed about the environment?

a) general education at school
b) reading the newspaper, magazines, books, and pamplets
c) TV and radio
d) talking with friends, parents, and other people
e) attending special meetings about environmental problems

65. Are you a member of any of the following organizations? You may choose more than one.

a) Boy Scouts or Girls Scouts
b) 4-H Clubs
c) Future Farmers of America
d) science clubs, biology clubs or chemistry (JETS, Jr. LAS)
e) any conservation organization (Nat. Wildlife Fed., Sierra Club, etc.)

Please answer the following questions on your answer sheet.

66. What is your sex?

a) male b) female

67) What is your age?

a) 14 b) 15 c) 16 d) 17 e) 18

68) Are you presently enrolled in a science course?

a) yes b) no

69. If you are enrolled in a science course, what course are you enrolled?

a) biology b) chemistry c) physical science d) earth science e) other

70. What is your race?

a) Asian b) Black c) White

STATE OF LOUISIANA
DEPARTMENT OF EDUCATION

J. KELLY NIX
State Superintendent

P. O. Box 44064
Baton Rouge, La.
70804

DIRECTIONS FOR ADMINISTERING ENVIRONMENTAL KNOWLEDGE AND OPINION INVENTORY FOR LOUISIANA

Content of Packet

This packet contains a set of thirty (30) inventories and thirty (30) answer sheets. The inventories should be used with a representative sample of tenth grade students.

Time Required to Administer the Inventory

The time to complete the inventory for most students should be about 40 minutes. If they finish earlier, they should be encouraged to review their responses. Please allow all of the students to finish. There is no time limit.

Selection of Representative Classes

One tenth grade class should be selected to complete the inventories. The class should be as representative of your school population as possible.

Administration of the Inventory

1) Select a person to administer the inventory.

2) The students should all meet together for administration of the instruments.

3) Distribute the inventories and answer sheets.

4) Be certain that each student has a No. 2 1/2 or softer pencil.

5) Have the students write the name of their school in the blanks provided at the top of side two and darken the letters under NAME.

6) Have the students fill in the school identification number on their answer sheet in the space marked IDENTIFICATION NUMBER. The number for your school is _____. (Darken the numbers)

7) The student should write their name on the answer sheet.

INSTRUCTIONS FOR MARKING THE ANSWER SHEET

Students should mark the space that corresponds to their answer for each item. The space marked should be completely darkened. If an answer is to be changed, it should be completely erased; wrong answers should not be crossed out. The answer sheets will be scored electronically, so following these directions is very important.

For multiple choice items, response a should be marked in column 1;
b should be marked in column 2;
c should be marked in column 3;
d should be marked in column 4;
e should be marked in column 5;

After the students have completed the inventories, the answer sheets should be returned to the Principal.

Students Response

A summary of the student responses for your school will be returned to you within a month after we receive them.

MAILING OF RESPONSES

Please use the self-addressed envelope. Return all answer sheets and copies of inventories to:

Donald W. McGehee
Science Supervisor
State Department of Education
Baton Rouge, Louisiana 70804

ANALYSIS OF THE INVENTORY

The analysis of the inventory will be conducted by James E. Barr, a doctoral student in educational research at Louisiana State University. Inquiries regarding this analysis may be addressed to:

James E. Barr
c/o Office of Institutional Research
Room 123 System Building
Louisiana State University
Baton Rouge, Louisiana 70893

STATE OF LOUISIANA
DEPARTMENT OF EDUCATION

J. KELLY NIX
State Superintendent

P. O. Box 44064
Baton Rouge, La.
70804

February 6, 1980

E

Dear E:

The Science Section of the Louisiana State Department of Education is assisting in a survey of the environmental knowledge and opinions of tenth grade students in Louisiana. The survey will form the basis on which to provide guidelines for a plan in environmental education in Louisiana.

To obtain this information on a statewide basis, we have selected at random a number of secondary schools. Your school was selected in the process. We would appreciate receiving information from a representative group of 20-30 sophomores. You may select a science class, biology class, homeroom, or any group of sophomores as long as they are representative of the students in your school. An inventory of 40-50 items carefully selected from hundreds of objectives will be provided. Various faculty members at the Louisiana State University in Baton Rouge participated in the selection of the objectives from which questions for the inventory were obtained. Many of the faculty assisting are renowned specialists in their fields. Some of these are Dr. Jerry B. Graves and Dr. Leo D. Newsom, Department of Entomology, Dr. Nicholaus H. Fischer and Dr. Philip West, Department of Chemistry, and Dr. James Gosselink and Dr. James Schweitzer, Department of Marine Sciences.

The inventory will not take an entire class period. The students' responses will not require any personal information. No information regarding individual schools or parishes will be disclosed during or after this study; however, you will receive a copy of the responses from your school, as well as a tabulated summary of the total responses from around the state. Your curriculum planners and teachers should find this information helpful.

An analysis of the study will be conducted by James E. Barr, a doctoral student in Educational Research at Louisiana State University in Baton Rouge.

A form to indicate if your school will participate is enclosed. Please return this form by February 22. Your instrument package will be mailed out as soon as your form is received. We look forward to working with you on this project.

Thank you for cooperation.

Sincerely,

Donald W. McGehee
Science Supervisor

DWMcG:gl

Enclosure

TO: *Donald W. McGehee*
Science Supervisor
State Department of Education
Baton Rouge, Louisiana 70804

FROM: *Name*_____

*Position*_____

*School*_____

*City*_____ *State* *Louisiana* *Zip*_____

Please check the appropriate space.

_____1. *We will participate in the survey. Please send inventories and directions from administration.*

_____2. *We are interested in participating, but permission must be requested. Request permission from:*

*Name*_____

*Position*_____

*Street Address*_____

*City*_____ *State* *Louisiana* *Zip*_____

_____3. *We are not able to participate in the survey.*

May 12, 1980

[redacted]

Dear [redacted],

Several weeks ago you indicated that your school would be willing to participate in a Statewide Environmental Survey conducted by the Louisiana State Department of Education. We sent you a packet of materials, including answer sheets which you were to return.

As of yet we have not received the answer sheets and thought perhaps they did not arrive or were forgotten. Please notify us if more inventories are needed. The answer sheets may be returned at library rate.

If you have already sent your forms, please disregard this note

We would apreciate your participation.

Sincerely,

James E. Barr
Research Assistant

Campus Correspondence LOUISIANA STATE UNIVERSITY

From: James E. Barr
c/o Office of Institutional Research
P.O. Box 20470-A
LSU - SYSTEM
Baton Rouge, LA. 70895

Date: January 15, 1980

To:

I am developing a needs-based curriculum plan in environmental education for Louisiana with the help of the Louisiana State Department of Education. Before any such curriculum development can be done, some assessment of the knowledge and opinions students have about the environment must be undertaken to determine what they already know and believe about the environment. To assess the students of such knowledge and opinions, an accurate instrument must be developed. The questions in the instrument will have to be developed from basic objectives related to environmental science.

Enclosed is a list of objectives that I have developed from other state plans with the hope that some of them will be applicable for Louisiana. I would like you to examine each objective for its validity and importance. Rate each objective critically. You may add or delete words to change the statement if you feel it is necessary.

Your recommendations will be used to develop the instrument. The target group to be tested will consist of tenth grade students selected from public high schools.

If you have any questions, please feel free to call me at 388-5475. Your participation in this evaluation process is greatly appreciated. Enclosed is a self-addressed envelope. Thank you.

Sincerely,

James E. Barr

The following objectives will form the basis for possible questions to be used in accessing high school students' knowledge and attitudes about the environment. Rate each of these concepts critically according to its importance and validity in relation to the others in the same section. Since the instrument will consist of only 40-50 questions, your responses will serve in selecting the objectives for the questions. Feel free to augment this list.	strongly agree	agree	neutral	disagree	strongly disagree	no opinion
POPULATION						
1) knows that our increasing world population is one of our greatest crises.	1	2	3	4	5	6
2) knows that all organisms have the capability of reproducing beyond the availability of food resources.	1	2	3	4	5	6
3) knows that man has the biological capability of reproducing faster than he can grow food.	1	2	3	4	5	6
4) understands why the world's population is increasing despite a simultaneous decrease in birth rate.	1	2	3	4	5	6
5) understands the effect increasing population has on resources.	1	2	3	4	5	6
6) understands the effect increasing population has on the individual.	1	2	3	4	5	6
7) understands the effect increasing population has on the social structure of a civilization.	1	2	3	4	5	6
8) recognizes possible factors influencing changes in population growth rates as associated with nativity, mortality, and predation/parasitism.	1	2	3	4	5	6
9) identifies what is meant by urbanization.	1	2	3	4	5	6
10) recognizes specific changes in socio-cultural conditions brought about by industralization.	1	2	3	4	5	6
11) recognizes that an individual's attitude and action can affect population control.	1	2	3	4	5	6
12) knows that the environmental quality is affected by the social-economic climate in which people live.	1	2	3	4	5	6
ECONOMICS						
13) understands the role of government in furthering economic prosperity.	1	2	3	4	5	6
14) understands the basic economic concepts of democracy, socialism, and communism.	1	2	3	4	5	6
15) understands the connection between resources and prosperity.	1	2	3	4	5	6

	strongly agree	agree	neutral	disagree	strongly disagree	no opinion
16) understands that war and waste bring about a rapid depletion of a nation's resources.	1	2	3	4	5	6
17) recognizes differences between the concepts of growth and "limits to growth."	1	2	3	4	5	6
RESOURCE USE (General)						
18) identifies factors affecting the use of natural resources.	1	2	3	4	5	6
19) understands that natural resources are unequally distributed with respect to the land that is available to a nation.	1	2	3	4	5	6
20) knows that the use or misuse of a nation's land and its resource affects themselves and others.	1	2	3	4	5	6
Soil						
21) knows that soil production occurs by the weathering of rocks.	1	2	3	4	5	6
22) recognizes the extent to which soil is lost annually due to erosion.	1	2	3	4	5	6
23) understands productivity difference in soils.	1	2	3	4	5	6
Air						
24) knows the major components in the atmosphere.	1	2	3	4	5	6
25) knows that a large percentage of the oxygen comes from the extensive forested regions around the world and from the ocean.	1	2	3	4	5	6
26) understands that changes in our atmosphere may change the climate.	1	2	3	4	5	6
Forest						
26) identifies one method used by foresters to harvest wood.	1	2	3	4	5	6
27) understands the value of forests in helping prevent floods and insuring a continuous supply of pure water.	1	2	3	4	5	6
28) understands the concept of multiple use in forest management.	1	2	3	4	5	6
29) recognizes that recycling paper products is a means of helping conserve our forests.	1	2	3	4	5	6

	strongly agree	agree	neutral	disagree	strongly disagree	no opinion
Wildlife						
30) understands that wildlife populations are important economically, aesthetically, and biologically.	1	2	3	4	5	6
31) understands that wildlife must be conserved and controlled to prevent extinction or overpopulation.	1	2	3	4	5	6
32) understands that man has hastened the extinction or threat of extinction of certain animal species by direct exploitation.	1	2	3	4	5	6
33) recognizes that the regulated harvest of wildlife by recreational hunting and fishing is man's way of removing surpluses which would otherwise be removed naturally.	1	2	3	4	5	6
Water						
34) recognizes the different water problems in different regions of the country.	1	2	3	4	5	6
35) recognizes that water usage and needs per person are increasing each year.	1	2	3	4	5	6
36) understands that the water table and subsequent amount of percipitation that becomes available for use by man varies with topography, land use, and applied management practices.	1	2	3	4	5	6
37) recognizes the value of the wetlands.	1	2	3	4	5	6
Conservation						
38) knows that conservation is the careful preservation and protection of national resources to insure an adequate supply for the present and the future.	1	2	3	4	5	6
39) identifies that a natural area is any place where the biotic elements and organisms are protected and held in an undisturbed state for the benefit of all mankind.	1	2	3	4	5	6
Human Resources						
40) understands that the concept of a comprehensive long-range planning must become the rule rather than the exception if we are to maintain harmony between man and the environment.	1	2	3	4	5	6

	strongly agree	agree	neutral	disagree	strongly disagree	no opinion
POLLUTION						
Air						
41) knows that the constant composition of the atmosphere can be upset by the activities of man.	1	2	3	4	5	6
42) knows that air pollution is atmospheric contamination which can be detected and measured.	1	2	3	4	5	6
43) recognizes several sources of air pollution.	1	2	3	4	5	6
44) knows that pollutants and contaminates are produced by natural and man-made processes.	1	2	3	4	5	6
45) knows that air pollution contributes to the deteriation of metals, brick, and cement, and has a negative effect upon animals and plants.	1	2	3	4	5	6
Water						
46) knows that the ocean is the final dumping place for many pollutants.	1	2	3	4	5	6
47) knows that the amount of usable water on earth is reduced by pollution.	1	2	3	4	5	6
48) knows that agricultural activities often deteriorate the quality of water.	1	2	3	4	5	6
49) knows that the present water quality is influenced by human pressures.	1	2	3	4	5	6
50) knows that chemicals, raw sewage, oil, and agricultural waste can contribute to the pollution of lakes, rivers, and sea shores.	1	2	3	4	5	6
51) knows that the effluent or seepage from a sewage treatment facility negatively affects plant life, animal life, and public health.	1	2	3	4	5	6
Noise						
52) recognizes that noise pollution is an increasing problem in a growing industrial nation.	1	2	3	4	5	6
53) understands that too much noise can be physically, mentally, and emotionally harmful.	1	2	3	4	5	6

	strongly agree	agree	neutral	disagree	strongly disagree	no opinion
PHYSICAL/CHEMICAL						
Climate/Weather						
54) understands that an atmosphere filled with pollutants can prevent warming sunlight from reaching the earth and can eventually change the climate.	1	2	3	4	5	6
55) knows that the atmosphere acts like like glass in a greenhouse allowing the light to pass through but holding back the harmful radiation.	1	2	3	4	5	6
56) recognizes that the climate is critical to our existance.	1	2	3	4	5	6
57) knows that the oceans contribute to our climate.	1	2	3	4	5	6
58) recognizes that if we alter the atmosphere we may change the climate.	1	2	3	4	5	6
Fossil Fuels/Minerals						
59) recognizes that ecologically sound ways of mining and recycling can help conserve our mineral resources.	1	2	3	4	5	6
60) identifies the meaning of "finite supply" of natural resources.	1	2	3	4	5	6
61) identifies examples of non-renewable resources.	1	2	3	4	5	6
62) estimates the length of time the known reserves of zince, copper, tin, petroleum, and lead will be depleted at today's rate of consumption.	1	2	3	4	5	6
63) estimates the percentage of petroleum imported into the U.S.	1	2	3	4	5	6
64) recognizes examples of renewable resources.	1	2	3	4	5	6
65) understands that minerals are an exhaustable and non-renewable resource.	1	2	3	4	5	6
Food						
66) recognizes that without the present and future utilization of fertilizers, the world would suffer from massive starvation.	1	2	3	4	5	6
67) understands that modern-day fertilizers require energy for their production.	1	2	3	4	5	6
68) understands the need for pesticides which substitute for natural enemies of pests.	1	2	3	4	5	6

	strongly agree	agree	neutral	disagree	strongly disagree	no opinion
69) understands that pesticides must be carefully used since they are detrimental to many unintended species when used improperly.	1	2	3	4	5	6
70) understands that there has been a shift in land use away from agricultural land to urbanization.	1	2	3	4	5	6
Energy						
71) identifies the source of energy that has been demonstrated through research and technical break-through which can be obtained on a large scale.	1	2	3	4	5	6
72) recognizes that the sun, wind, tides, and the atom are all sources of energy that may be used for mechanized power.	1	2	3	4	5	6
73) understands that some kinds of energy produce more pollution than others.	1	2	3	4	5	6
74) estimates the percentage of energy supplied by fossil fuels in the U.S.	1	2	3	4	5	6
75) understands that the earth is a limiting support system powered by the energy of the sun and energy made available through technological achievements.	1	2	3	4	5	6
76) understands that mechanical energy can be transforned into heat energy.	1	2	3	4	5	6
77) knows that mater and energy can neither be created or destroyed, simply transformed.	1	2	3	4	5	6
78) understands that the universe, and therefore earth, are in constant change.	1	2	3	4	5	6
Natural Cycles/Recycling						
79) recognizes that biological systems are described as dynamic because the materials and energy involved are parts of continous cycles.	1	2	3	4	5	6
80) understands that inorganic materials and energy become part of organic matter and are subsequently broken down into substances and energy.	1	2	3	4	5	6
81) knows that the basic natural cycles include the hydrologic cycle, the gaseous cycles, and the nutrient cycles.	1	2	3	4	5	6
82) recognizes that since the supply of matter is finite, the continuation of life depends upon a cyclic flow of materials between organisms and their environments.	1	2	3	4	5	6

	strongly agree	agree	neutral	disagree	strongly disagree	no opinion
83) recognizes that the natural cycles and systems on spaceship earth have limited capacity to cycle or dispurse natural and/or manufactured pollutants.	1	2	3	4	5	6
BIOLOGICAL						
84) knows that living things are grouped according to similarities and differences.	1	2	3	4	5	6
85) understands that plants including the trees purify the air, provide a cover to hold the soil in place, protect the water supply, shelter wildlife, supply many materials for man's needs and add beauty to the landscape.	1	2	3	4	5	6
86) knows that green plants are the ultimate sources of food, clothing, shelter, and energy in most societies.	1	2	3	4	5	6
87) knows that green plants get matter from the environment and energy from the sun for growth.	1	2	3	4	5	6
88) knows that green plants differ from other organisms in that they make and provide food for the living world.	1	2	3	4	5	6
89) understands that living things capture matter from the environment and return in to the environment.	1	2	3	4	5	6
90) understands that all living things have a specific role or niche and habitat within their environment.	1	2	3	4	5	6
91) knows that animals may be classified as herbivores, carnivores, detritivores, or omnivores.	1	2	3	4	5	6
Adaptation/Change/Specialization						
92) knows that some forms of living things have become extinct.	1	2	3	4	5	6
93) recognizes that man changes the natural environment to the extent that many species find it difficult to adapt to the new conditions.	1	2	3	4	5	6
94) understands that the rate of change in an environment may exceed the rate of organism adaptations.	1	2	3	4	5	6
95) recognizes that the more spceialized an organism becomes the less adaptable it is, and the less able to survive environmental change.	1	2	3	4	5	6

	strongly agree	agree	neutral	disagree	strongly disagree	no opinion
96) understands that as the environment changes, organisms become adapted through natural selection.	1	2	3	4	5	6
97) understands that when any organisms' environment is altered it must become adapted to survive.	1	2	3	4	5	6
Continuity						
98) knows that animals usually produce far more young than the environment can support.	1	2	3	4	5	6
99) understands that the genetic code may be changed by environmental factors.	1	2	3	4	5	6
100) knows that the characteristics of living things are determined by their genetic make-up.	1	2	3	4	5	6
101) understands that heredity and environment interact to determine the characteristics of an organism and therefore, a population.	1	2	3	4	5	6
102) recognizes that organisms and environments are in constant change.	1	2	3	4	5	6
Balance						
103) understands that the basic function of an ecosystem is to capture and transfer energy.	1	2	3	4	5	6
104) knows that in a healthy ecosystem predator species are less abundant than their prey species.	1	2	3	4	5	6
Diversity						
105) knows that diversity is a key factor in the survival of an ecosystem.	1	2	3	4	5	6
Interrelationships/Interdependence						
106) understands that as organisms feed upon each other the transfer of food energy is not 100% efficient: some energy is lost.	1	2	3	4	5	6
107) recognizes that living things depend on the producer, consumer, and decomposer cycle for survival.	1	2	3	4	5	6
108) understands that all living things fit into a food web.	1	2	3	4	5	6
109) understands that each member of the community is dependent on every other member of the community.	1	2	3	4	5	6

		strongly agree	agree	neutral	disagree	strongly disagree	no opinion
110)	understands that animals must obtain their food materials by feeding on other animals and/or plants.	1	2	3	4	5	6
111)	knows that as a by-product of photosynthesis, green plants produce oxygen which both plants and animals need for respiration.	1	2	3	4	5	6
112)	recognizes that the addition or removal of a species of organisms from a community may cause harmful or beneficial results.	1	2	3	4	5	6
113)	understands that the destruction of wildlife may lead to the eventual collapse of food chains.	1	2	3	4	5	6
114)	recognizes that man is dependent upon producers for his food.	1	2	3	4	5	6
	Limiting Factors						
115)	understands that food is a limiting factor in populations.	1	2	3	4	5	6
116)	understands that the demand for space by some animal species is an inherited behavior pattern which often causes space to become a limiting factor.	1	2	3	4	5	6
117)	recognizes earth's carrying capacity is limited for a all species including man.	1	2	3	4	5	6
118)	knows that other planets within our solar system are incapable of supporting life as we know it.	1	2	3	4	5	6
119	knows that a space craft is an example of a close environmental system.	1	2	3	4	5	6
120)	understands that the carrying capacity is determined by the availability of materials and conditions necessary for maintaining a particular kind of organism.	1	2	3	4	5	6
	Community/Populations						
121)	knows that a biological community refers to all plants and animals that occupy a specific area.	1	2	3	4	5	6
	Habitats						
122)	understands that there are many types of habitats, each with its own characteristic life.	1	2	3	4	5	6
123)	knows that each biome is an interesting part of the total earth ecosystem.	1	2	3	4	5	6

	strongly agree	agree	neutral	disagree	strongly disagree	no opinion
Man-Made Environments						
124) recognizes that man can alter natural processes, but he can not improve on them.	1	2	3	4	5	6
125) understands that man is living on the earth and must be guided by the interrelationships and interactions of the total earth ecosystem in establishing artificial environments.	1	2	3	4	5	6
Recreation						
126) understands that the improper or overuse of recreational areas causes land management problems and cost the taxpayer money.	1	2	3	4	5	6
127) recognizes that man needs wilderness and natural areas for recreational as well as for their scientific and economic value.	1	2	3	4	5	6
128) understands that recreational activities can be limited by pollution.	1	2	3	4	5	6
129) recognizes that there is a problem of private exploitation of recreational resources.	1	2	3	4	5	6
ENVIRONMENTAL MANAGEMENT						
Policies/Politics/Law						
130) understands that policies regarding the environment should seek to enrich the lives of people from all socioeconomic classes.	1	2	3	4	5	6
131) recognizes that governments can conserve more natural resources wherein individuals cannot.	1	2	3	4	5	6
132) recognizes that man is attempting to control some environmental problems by enforcing laws and enacting legislation.	1	2	3	4	5	6
133) understands that environmental decisions are made by both private individual and groups and public bodies or their agents.	1	2	3	4	5	6
134) understands that public opinion constitutes control over the use of conservation practices.	1	2	3	4	5	6

APPENDIX B

Appendix B

Sex Distribution of Students by Region (Percentage)

	REGION							
Sex	1	2	3	4	5	6	7	8
Female	61	57	51	55	63	52	53	57
Male	39	43	49	45	37	48	47	43
Total	26	18	5	9	7	10	15	9

APPENDIX C

Appendix C

Distribution of Urban/Rural Students by Sex (Percentage)

SEX	URBAN	RURAL
female	59	54
male	41	46
total	59	41

APPENDIX D

Appendix D

Correct Responses to Knowledge Variables By Region

	Percentage By Region							
Variable Name	1	2	3	4	5	6	7	8
Population Crisis	18	16	7	17	13	22	19	21
Bio-Capacity	36	32	47	31	35	40	30	34
Population Increase	46	40	38	42	43	45	51	41
Population & Resources	69	70	76	63	73	75	72	62
Ocean Pollution	26	22	26	21	24	22	27	21
Aquatic Pollution	64	65	70	63	70	78	71	65
Non-Renewable Resources	29	29	22	22	40	40	34	32
Soil Productivity	60	58	75	54	63	57	53	53
Green Plant Factors	45	49	51	58	39	55	52	43
Interdependence	58	49	55	54	53	61	56	43
Particle Pollution	22	18	20	28	26	20	23	21
Oxygen Source	31	34	25	29	36	24	33	36
Wood Shortage	49	47	50	42	37	38	43	35
Wildlife	53	58	53	68	54	54	57	47
Wetlands	28	20	22	23	20	6	11	4
Affects of Fossil Fuel	45	55	63	48	47	52	45	48
Air Pollution	80	81	80	80	77	85	82	81
Energy Source	56	50	53	62	45	57	45	59
Energy and Food	30	27	24	26	30	23	28	31
Least Polluting Energy	30	31	30	38	33	30	37	29

(Appendix D continued)

Variable Name	Percentage By Region							
	1	2	3	4	5	6	7	8
Fossil Fuel Used	32	32	21	27	33	2?	29	30
Major Source of Energy	43	42	43	39	41	37	54	31
Photosynthesis Product	41	43	40	33	32	42	38	34
Food Web	58	51	70	45	51	65	59	48
Role of Green Plants	20	25	25	32	29	36	27	22
Temperature Change	61	58	68	55	53	60	61	61
Agri-Water Problems	47	47	50	50	44	55	35	47
Cause of Extinction	54	54	55	52	46	53	45	47
Environmental Cycles	50	43	40	44	36	43	41	42
Finite Resources	48	38	43	39	39	44	39	39
Noise Damage	64	65	62	60	60	65	68	61
Pesticides	70	78	79	74	76	88	75	76
Hunting	36	37	41	50	46	42	36	43
Population Limits	40	51	43	41	37	41	40	32
Source of Air Pollution	71	75	72	69	67	85	73	72
Erosion	51	57	54	46	50	63	54	40
Earth's Capacity	73	77	82	76	73	83	76	74
Population Level	28	30	37	29	23	36	33	38
Sewage Effects	64	70	72	62	63	76	68	64
Fresh Water Problems	44	41	46	44	46	46	44	43
Noise Problems	62	62	72	63	59	71	64	61
Recreation Use	55	59	62	57	53	62	63	55
Recreation Limits	17	19	18	20	30	25	21	17

Appendix D

Responses to Knowledge Variables By Sex

Variable Name	Percentage of Correct Responses	
	Female	Male
Population Crisis	17	18
Eio-Capacity	35	34
Population Increase	47	40
Population and Resources	68	72
Ocean Pollution	20	28
Aquatic Pollution	71	63
Non-renewable Resources	32	30
Soil Productivity	56	61
Green Plant Factors	47	51
Interdependence	53	56
Particle Pollution	19	26
Oxygen Source	30	33
Wood Shortage	45	43
Wildlife	58	52
Wetlands	14	23
Affects of Fossil Fuel	49	50
Air Pollution	85	76
Energy and Food	31	24
Energy Source	52	56
Least Polluting Energy	27	38

(Appendix D continued)

Percentage of Correct Responses By Sex		
Variable Name	Female	Male
Fossil Fuel Used	26	34
Major Source of Energy	39	47
Photosynthesis Product	35	44
Food Web	54	58
Role of Plants	27	25
Temperature Change	60	59
Agri-Water Problems	46	47
Cause of Extinction	50	54
Environmental Cycles	43	45
Finite Resources	38	47
Noise Damage	67	59
Pesticides	76	75
Hunting	40	40
Population Limits	41	42
Source of Air Polution	77	68
Erosion	53	52
Earth's Capacity	78	74
Population Level	34	27
Sewage Effects	72	60
Fresh Water Problems	48	38
Noise Problems	66	61
Recreation Use	63	52
Recreation Limits	19	21

Appendix D

Correct Responses to Knowledge Variables By Community Type

Variable Name	Percentage of Correct Responses	
	Urban Community	Rural Community
Population Crisis	16	20
Bio-Capacity	35	34
Population Increase	46	41
Population and Resources	71	68
Ocean Pollution	25	22
Aquatic Pollution	71	63
Non-renewable Resources	31	30
Soil Productivity	62	53
Green Plant Factors	48	49
Interdependence	58	49
Particle Pollution	23	21
Oxygen Source	30	34
Wood Shortage	47	38
Wildlife	56	55
Wetlands	19	17
Affects of Fossil Fuel	51	47
Air Pollution	83	78
Energy and Food	31	24
Energy Source	57	49
Least Polluting Energy	33	30

(Appendix D continued)

	Percentage of Correct Responses	
Variable Name	Urban Community	Rural Community
Fossil Fuel Used	30	29
Major Source of Energy	43	42
Photosynthesis Product	42	35
Food Web	59	51
Role of Plants	28	23
Temperature Change	61	58
Agri-Water Problems	46	47
Cause of Extinction	52	51
Environmental Cycles	45	42
Finite Resources	44	38
Noise Damage	67	60
Pesticides	77	74
Hunting	39	41
Population Limits	42	41
Sources of Air Pollution	73	73
Erosion	52	52
Earth's Capacity	77	75
Population Level	32	31
Sewage Effects	69	64
Fresh Water Problems	43	46
Noise Problems	65	62
Recreation Use	58	58
Recreational Limits	21	19

Appendix D

Correct Responses To Knowledge Variables By Size of School

Variable Name	Percentage of Correct Responses			
	Size 1 (100-499)	Size 2 (500-999)	Size 3 (1000-1499)	Size 4 (1500 +)
Population Crisis	20	21	14	14
Bio-Capacity	31	40	33	37
Population Increase	45	43	41	50
Population and Resources	65	73	69	73
Ocean Pollution	22	24	24	28
Aquatic Pollution	65	65	68	73
Non-Renewable Resources	31	32	29	33
Soil Productivity	52	55	59	71
Green Plant Factors	54	46	46	49
Interdependence	52	53	51	67
Particle Pollution	21	21	23	23
Oxygen Source	33	33	31	28
Wood Shortage	33	44	47	56
Wildlife	56	52	55	62
Wetlands	13	17	18	29
Affects of Fossil Fuel	50	40	52	55
Air Pollution	77	84	80	85
Energy and Food	23	27	29	35
Energy Source	45	57	55	62
Least Polluting Energy	31	28	31	38

(Appendix D continued)

	Percentages of Correct Responses			
	Size 1	Size 2	Size 3	Size 4
Variable Name	100-499	500-999	1000-1499	1500 +
Fossil Fuel Used	28	28	29	35
Major Source of Energy	45	40	41	45
Photosynthesis Product	34	37	40	47
Food Web	48	59	55	65
Role of Plants	26	24	29	22
Temperature Change	57	61	60	62
Agri-Water Problems	44	47	45	50
Cause of Extinction	47	54	48	62
Environmental cycles	39	44	42	55
Finite Resources	34	42	41	55
Noise Damage	58	64	64	72
Pesticides	73	80	74	78
Hunting	36	44	39	40
Population Limits	39	43	42	43
Source of Air Pollution	72	79	69	75
Erosion	51	55	49	55
Earth's Capacity	73	81	74	77
Population level	30	32	34	27
Sewage Effects	63	68	64	76
Fresh Water Problems	42	49	43	41
Noise Problems	58	69	64	66
Recreation Use	56	61	58	58
Recreational Limits	21	17	22	21

APPENDIX E

Appendix E

Student Opinions About Environmental Issues by Region

	REGION															
	1		2		3		4		5		6		7		8	
Affective Variable	A	D	A	D	A	D	A	D	A	D	A	D	A	D	A	D
Population Planning	56	44	29	28	53	16	41	20	52	14	62	10	61	14	56	16
Relax Restrictions	28	28	32	31	28	26	30	31	33	23	27	32	27	22	28	26
Land Use	50	15	50	20	57	15	55	11	49	16	59	16	52	13	46	19
International Rationing	41	24	47	23	45	25	39	26	40	18	40	27	43	26	45	20
Require Recycling	60	13	59	14	74	9	62	9	58	10	65	12	56	15	48	19
Economic Values	32	36	37	34	29	45	41	28	35	30	31	45	33	40	45	35
Ecological Exaggerations	14	46	14	51	11	54	12	47	19	46	17	50	17	50	19	43
Government Control	38	38	41	34	41	43	41	32	37	31	35	47	38	30	34	39
Individual Life Style	14	58	10	61	7	68	14	62	20	51	9	70	9	64	11	59
Environmental Protection	40	19	46	21	51	17	44	17	36	22	44	22	38	19	42	21
Individual Freedom	14	42	21	41	24	38	21	34	16	31	24	45	21	44	21	35
Resource Dependency	8	4	8	2	7	3	11	2	4	2	5	3	9	3	10	7
Long-Range Planning	53	11	61	8	68	8	53	7	57	11	72	7	52	13	52	13
Environmental Concern	34	32	41	32	32	37	37	31	38	26	35	39	34	31	35	31
Needs and Wants	68	7	74	8	84	5	70	8	59	11	81	4	70	6	70	7

Appendix E

Opinions About Environmental Concepts By Sex (Percentage Responding)

Variable Name	Female			Male		
	agree	disagree	no opinion or neutral	agree	disagree	no opinion or neutral
Population Planning	59	13	28	51	17	31
Relax Restrictions	28	23	50	30	34	35
Land Use	50	16	33	54	16	28
International Rationing	46	22	32	38	27	34
Require Recycling	35	37	27	35	36	28
Economic Values	59	13	28	51	17	31
Government control	35	40	25	43	32	23
Individual Freedom	17	43	39	23	36	39
Resource Dependency	8	3	87	8	3	86
Long-Range Planning	58	7	33	56	13	28
Environmental Concern	37	31	31	34	34	29
Needs and Wants	75	6	18	66	9	22

Appendix E

Students Opinions About The Environment By Community Type
Percentage Responding

	Urban Community			Rural Community		
Affective Variable	agree	disagree	no opinion[1] or neutral	agree	disagree	no opinion[1] or neutral
Population Planning	56	14	29	55	16	29
Relax Restrictions	28	28	43	30	28	41
Land Use	52	15	31	51	16	31
Rationing	39	25	38	48	22	29
Require Recyclying	60	13	26	58	13	28
Economic Values	32	39	28	39	33	27
Ecological Exaggeration	16	50	33	15	46	37
Government Control	38	36	24	39	36	25
Individual Life Style	10	64	25	14	57	28
Environmental Protection	42	18	49	43	22	34
Individual Freedom	19	43	38	20	38	40
Resource Dependency	7	3	88	9	4	85
Long-Range Planning	58	10	30	57	11	32
Environmental Concerns	34	32	32	38	33	27
Needs and Wants	71	7	20	72	7	19

[1]/ The responses were combinded.

Appendix E

Opinions of Environmental Concepts By Size of School
(Agree and Disagree only)

	Percentages of Responses By School							
	Size 1		Size 2		Size 3		Size 4	
Affective Variable	A	D	A	D	A	D	A	D
Population Planning	52	16	61	15	53	14	58	15
Relax Restrictions	27	28	33	26	30	26	26	34
Land Use	49	17	53	18	51	15	55	12
Rationing	46	23	43	26	39	24	41	24
Require Recycling	55	14	59	14	60	13	64	11
Economic Values	37	32	40	35	33	39	28	41
Ecological Exaggeration	16	45	16	48	16	48	12	55
Government Control	35	38	41	37	38	36	40	36
Individual Life Style	15	58	12	62	11	63	9	65
Environmental Protection	42	22	42	25	41	22	46	16
Individual Freedom	22	36	18	45	21	39	15	41
Resource Dependency	9	4	8	2	8	3	7	3
Long-Range Planning	53	11	63	11	57	10	57	7
Environmental Concerns	38	32	36	34	35	30	34	31
Needs and Wants	70	7	75	7	69	8	74	5

APPENDIX F

Appendix F

Community Problems By Region

	Percentage Responding By Region							
Problem	1	2	3	4	5	6	7	8
Land Use	17	16	12	19	22	28	22	24
Traffic	13	13	12	12	14	10	18	15
Air & Water	20	23	25	11	26	12	13	13
Waste	19	30	29	39	30	32	25	23
Crime	28	18	20	17	12	18	22	25

Appendix F

Opinions About Community Problems By Sex
(Percentage Responding)

	Sex	
Problem	Male	Female
Land Use	24	16
Traffic Problems	15	12
Air and Water	15	20
Waste Disposal	26	27
Crime	18	24

Appendix F

Opinions About Community Problems By Community Type

	Percentage Responding	
Problem Area	Urban Community	Rural Community
Land Use	21	18
Traffic Problems	15	11
Air and Water Problems	17	19
Waste Disposal	22	34
Crime	24	18

Appendix F

Opinions About Community Problems By Size of School

	Percentages of Responses			
Problem	Size 1	Size 2	Size 3	Size 4
Land Use	21	20	20	17
Traffic Problems	9	12	16	17
Air and Water	17	19	19	14
Waste Disposal	34	30	20	22
Crime	16	20	25	28

APPENDIX G

Appendix G

Opinions About State Problems By Region

	Percentage Responding By Region							
Problem	1	2	3	4	5	6	7	8
Land Use	10	10	4	9	19	16	23	16
Air & Water	17	24	26	17	24	18	12	13
Waste	16	30	25	38	26	28	18	20
Health	12	12	12	13	14	12	14	24
Crime	43	24	33	23	15	23	32	27

Appendix G

Opinions About State Problems By Sex
(Percentage Responding)

	Sex	
Problem	Male	Female
Land Use	16	11
Air and Water	20	17
Waste Disposal	25	23
Public Health	13	14
Crime	24	35

Appendix G

Opinions about State Problems By Community Type

	Percentage Responding	
Problem	Urban Community	Rural Community
Land Use	13	14
Air and Water Pollution	18	18
Waste Disposal	23	24
Public Health	13	15
Crime	31	29

Appendix G

Opinions About State Problems By Size of School

	Percentage of Responses			
Problem	Size 1	Size 2	Size 3	Size 4
Land Use	16	15	12	9
Air and Water	9	12	16	17
Waste Disposal	25	24	25	19
Public Health	14	15	14	12
Crime	28	28	30	37

APPENDIX H

Appendix H

Opinions About National Problems By Region (first set)

	Percentage Responding By Region							
Problem	1	2	3	4	5	6	7	8
Land Use	9	9	9	8	10	6	6	7
Air & Water	29	26	30	26	30	41	27	28
Waste	15	13	7	16	7	8	7	10
Health	8	11	4	6	7	5	7	8
Crime	36	41	50	44	45	39	51	47

Appendix H

Opinions About National Problems By Sex (first set) (Percentage Responding)

	Sex	
Problem	Male	Female
Land Use	8	7
Air and Water	31	28
Waste Disposal	13	9
Public Health	7	8
Crime	37	47

Appendix H

Opinions About National Problems by Community Type (first set of questions)

	Percentage Responding	
Problem	Urban Community	Rural Community
Land Use	9	7
Air and Water Pollution	29	29
Waste Disposal	11	11
Public Health	7	8
Crime	42	44

Appendix H

Opinions About National Problems By Size of School (first set)

	Percentages of Responses			
Problem	Size 1	Size 2	Size 3	Size 4
Iand Use	6	7	9	10
Air and Water	28	31	29	28
Waste Dispcsal	11	11	11	12
Public Health	7	9	8	7
Crime	46	40	42	42

APPENDIX I

Appendix I

Opinions About National Problems By Region (second set)

	Percentage Responding By Region							
Problem	1	2	3	4	5	6	7	8
War Threat	21	22	36	23	28	29	25	26
Poverty	8	5	1	5	8	4	8	9
Energy	17	19	13	21	19	20	19	22
Energy/Resource Waste	40	42	42	38	40	42	33	36
Crime	9	10	7	11	6	2	13	7

Appendix I

Opinions About National Problems By Sex
(second set)
(Percentage Responding)

	Sex	
Problem	Male	Female
Threat of War	25	25
Poverty	7	6
Lack of Energy	23	16
Energy/Resource Waste	34	44
Education	10	8

Appendix I

Opinions About National Prcblems By Community Type (second set of questions)

	Percentage Responding	
Problem	Urban Community	Rural Community
Threat of War	27	21
Poverty	7	6
Lack of Energy	18	20
Energy and Resource Waste	39	40
Education	8	11

Appendix I

Opinions About National Problems By Size of School (second set)

	Percentages of Responses			
Problem	Size 1	Size 2	Size 3	Size 4
Threat of War	21	22	31	24
Poverty	7	4	7	7
Lack of Energy	20	21	18	15
Energy/Rescuce Waste	38	42	37	41
Education	12	8	6	10

APPENDIX J

Appendix J

World Problems By Region

	Percentage Responding By Region							
Problem	1	2	3	4	5	6	7	8
Poverty/Hunger	39	43	40	41	44	48	42	44
Population	17	16	11	12	12	16	17	12
Energy	16	14	18	21	22	11	16	16
War	18	20	24	18	18	18	19	27
Pollution	6	6	7	7	1	4	3	2

Appendix J

Opinions About World Problems By Sex
(Percentage Responding)

	Sex	
Problem	Male	Female
Poverty and Hunger	36	47
Population	16	14
Energy	15	17
War	22	17
Pollution	5	4

Appendix J

Opinions About World Problems By Community Type

	Percentage Responding	
Problem	Urban Community	Rural Community
Threat of War	42	42
Poverty	14	17
Lack of Energy	17	16
Energy/ Resource Waste	20	18
Education	5	5

Appendix J

Opinions About World Problems By Size Of School

	Percentages of Responses			
Problem	Size 1	Size 2	Size 3	Size 4
Poverty and Hunger	43	42	42	43
Population	17	18	13	12
Energy	17	12	17	18
War	17	20	21	20
Pollution	4	5	5	4

VITA

James E. Barr was born on October 11, 1950, in Shreveport, Louisiana.

He attended public school in Bossier City, Louisiana and graduated from Bossier High School in 1968. He attended Bossier Community College, Southern Unversity in Shreveport, and Louisiana Tech University in Ruston, Louisiana where he received a Bachelor of Science in Science Education in 1973, a Bachelor of Science in Zoology in 1975, and a Master of Science in Science Education in 1976. Between 1973 and 1978, Mr. Barr taught in both private and public schools and worked in various colleges on the Louisiana State University Campus in Baton Rouge.

His honors include membership in Sigma Xi, Phi Delta Kappa, American Association for the Advancement of Science, Societas Internationalis Odonatologica, and Louisiana Academy of Sciences

He is married to Cheryl Barkley Barr. They are parents of two children, James E. Barr Jr. and Julie Marie Barr.

EXAMINATION AND THESIS REPORT

Candidate: James E. Barr

Major Field: Education

Title of Thesis: Development of a Needs-Based Curriculum Plan in Environmental Education

Approved:

James W. Findley
Major Professor and Chairman

James D. Graynham
Dean of the Graduate School

EXAMINING COMMITTEE:

Dan Adams

Robert Blackmon

Wes McJulien

Jerry Brown

Leonard Kilgore

Date of Examination:

November 20, 1980